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# TEXAS AGRICULTURAL EXPERIMENT STATION

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COLLEGE STATION, BRAZOS COUNTY, TEXAS

BULLETIN NO. 459

SEPTEMBER, 1932

DIVISION OF AGRONOMY

## Grain Sorghum Varieties in Texas



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†As of September 1, 1932.

\*\*In cooperation with U. S. Department of Agriculture.

## SYNOPSIS

Grain sorghum, the basic grain and forage crop of West Texas, ranks third in value among the crops of Texas, yielding about sixty million bushels annually, which is approximately half the Nation's crop. Its excellent yield and quality of forage make it an important supplement to the corn crop in the central and southern part of the State, and in all except the extreme eastern part yields of grain quite comparable with those of corn can be obtained from the best adapted varieties.

Experiments have been conducted at various Substations during the years 1912 to 1931 to determine the varieties best suited to the conditions in the widely different regions of the State.

Grain sorghums have been grown in Texas since the late 1880's when Standard Yellow milo and Standard Blackhul kafir reached this State coming originally from foreign countries. Since that time many varieties have appeared; the exact origin of some is not known, others have been introduced from foreign countries, and many improved selections and new hybrid varieties have been distributed from experiment stations. The extreme differences in type and behavior between grain sorghum varieties allow a choice of a single variety to meet a particular condition and a thorough understanding of their growth habit and behavior is necessary in the proper use of the different varieties.

This Bulletin includes a discussion of the origin and a description of the varieties together with the yields in the various regions of the State, with recommendations regarding the varieties to grow. In the western part of the State, which is strictly a grain sorghum region, Dwarf Yellow milo, Texas Blackhul kafir, and Spur feterita are the varieties best adapted except where chinch bugs and accompanying disease damage milo. In the central and southern parts of the State, Hegari, Spur feterita, Texas Blackhul kafir, Chiltex, and Darso are the best varieties. In the more humid area to the east, Schrock and Darso are the most dependable for grain and forage; however, Hegari, Spur feterita, and kafir can be grown where bird damage is not too severe.

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## GRAIN SORGHUM VARIETIES IN TEXAS

R. E. Karper, J. R. Quinby,  
D. L. Jones, and R. E. Dickson

Grain sorghums are particularly adapted to the western two-thirds of Texas and although only about ten per cent of its cultivated land is planted to this crop, Texas leads all other states in grain sorghum production, growing slightly less than 50 per cent of the Nation's crop. Grain sorghums rank third in total production and money value among crops grown in the State, being exceeded only by cotton and corn. The average annual production is approximately sixty million bushels, having a value of about fifty million dollars for the grain alone. The forage incidental to this grain crop, along with sorgo hay, comprises the basic roughage on most Texas farms. Since the beginning of the present century grain sorghums have very materially changed the agricultural map of Texas. They have pioneered in the development of farming lands in all of the western part of the State and have been the important factor in changing this region from ranching to farming.

### THE SORGHUM AREA OF TEXAS

Grain sorghums are grown in the western two-thirds of the State almost to the exclusion of other feed crops. Farther east, grain sorghum is becoming an important crop as a supplement to corn because of its excellent yield and quality of forage when the whole plant is harvested as bundle feed and because the crop may be planted with reasonable expectation of success from as early as March 15 to as late as June 1. However, the grain yields of the best adapted varieties here often compare quite favorably with corn, and the acreage can well be further increased in this area. In the eastern part of the grain sorghum-producing area of the State, the acreage devoted to grain sorghums is dependent to some extent upon the crop prospects for corn and upon the need for forage.

The importance of the grain sorghums in the development of the western agricultural area of the State can readily be seen by comparing Fig. 1 with Fig. 2 and Fig. 3 with Fig. 4. As recently as the first decade of this century very little farming was done in the region now most densely occupied by grain sorghums. It will be noted that in 1919 (Fig. 1) the centers of grain sorghum production were largely in the four eastern tiers of counties in the Panhandle while the counties to the west were still, in the main, ranching lands. A decade later, 1929, (Fig. 2) the centers of heavy production had moved west and grain sorghums had again led in the agricultural development of these recent ranch lands. In these centers of grain production, Dwarf milo has been the predominating variety; however, kafir and feterita have also been important varieties. Much of the grain sorghum on these acreages

has been headed and marketed either as heads or as threshed grain. As this shift to the west was made, the cash crops, cotton in the southern and wheat in the northern part of the Panhandle, came in and occupied a considerable part of the acreage formerly devoted to the sorghums.

It will be noted further in Figs. 3 and 4, which show the acreage of grain sorghums and other sorghums grown for forage purposes, that during the past ten years the sorghums have come into a great deal more prominence in all parts of the State except the extreme eastern part. In Central and South Texas the acreage of sorghums cut for forage has doubled in many of the counties during the past ten years. This increased acreage has been planted largely to the better forage varieties of grain sorghums such as feterita, kafir, Darso and Hegari. A similar increase in acreage harvested for grain in this area can be seen from Figs. 1 and 2.

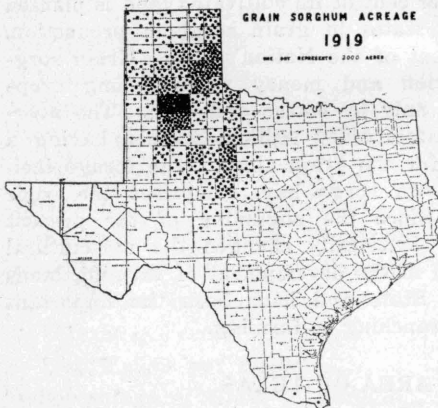


Fig. 1. Distribution of grain sorghum acreage harvested for grain. One dot represents 2,000 acres. (See Fig. 2.)

#### CLIMATIC CONDITIONS AND LOCATION OF EXPERIMENTS

Since grain sorghum is grown over such a large area in Texas, the crop encounters many different climatic conditions. In this large area the altitude ranges from almost sea-level to over 4,000 feet, average annual rainfall from 40 to 15 inches, average monthly relative humidity from almost 80 per cent to less than 60 per cent, and the length of the frost-free period from 290 to 175 days. A complete summary of the climatic conditions prevailing at each of the Substations where these trials were conducted will be found in Table 1. A study of the climatic conditions at the various locations of the experiments will be found helpful to a better understanding of the results presented later in this Bulletin. The character of the soil also has an important bear-

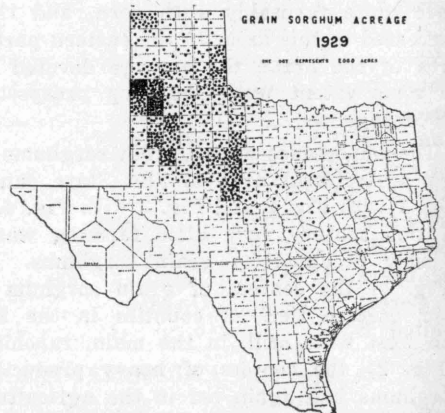


Fig. 2. Distribution of grain sorghum acreage harvested for grain in 1929. Note shift of production centers to the west and increased acreage to the east. (Fig. 1.)

ing upon the yields of grain sorghums, and both the climatic and soil conditions prevailing at each of the locations where the experiments were conducted are discussed more fully later on in connection with results

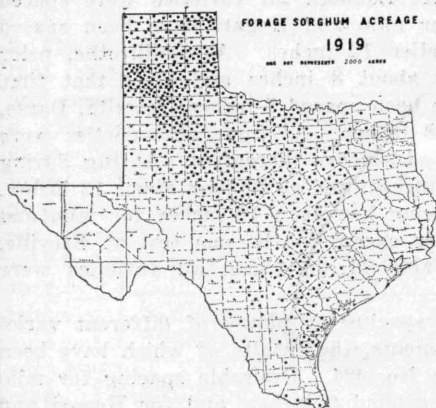


Fig. 3. Distribution of acreage in sorghums harvested for forage in 1919. One dot represents 2,000 acres. (See Fig. 4.)

at the specific station concerned. Since there is an appreciable difference among grain sorghum varieties in response to different environmental conditions, some varieties will be found better adapted to certain areas in the State than other varieties. Experiments have been conducted at 14 points in the State to determine the relative value of the various varieties for the different regions. These experiments have included trials at locations fairly well scattered over the State and including most of the major agricultural areas in Texas.

This Bulletin presents the results of yield trials of grain sorghum varieties conducted at Lubbock, Chillicothe, Spur, Dalhart, Big Spring, Iowa Park, Denton, Temple, Beeville, Weslaco, Angleton, College Station, Beaumont, and Troup. The work at the Chillicothe Station has been conducted cooperatively by the Texas Agricultural Experiment Station and the Division of Forage Crops and Diseases, United States Department of Agriculture. Inclusion of the results from Big Spring and Dalhart has been made possible through the courtesy of the Division of Dry-Land Agriculture, under whose direction these Stations are operated, and the Division of Cereal Crops and Diseases, United States Department of Agriculture.

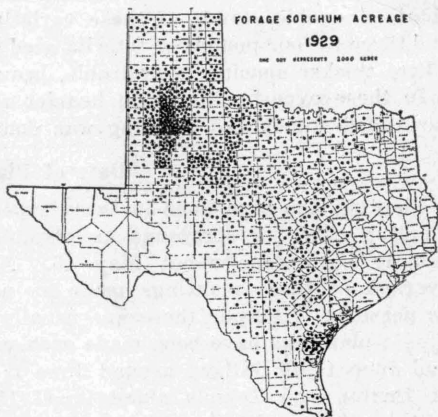


Fig. 4. Distribution of acreage in sorghums harvested for forage in 1929. (See Fig. 3.)

## EXPERIMENTAL METHODS

### Spacing of Plants

In these experiments an effort has been made to grow the crop under as nearly optimum conditions as possible. In the early years of the experiments plants of all varieties were given the same space within

the row, but as information was obtained concerning the response of varieties to different plant spacings, an effort was made to thin each individual plant to the spacing most favorable to production of the particular variety planted upon it. At Lubbock all varieties were spaced 18 inches until 1926 and thereafter milo and Hegari have been spaced 18 inches and the remaining varieties 12 inches. At Chillicothe, prior to 1925, all varieties were spaced about 8 inches and after that time the kafirs, Chiltex, and Premo have been spaced 8 inches; feterita, Darso, and Hegari 12 inches; and milo 18 inches. At Spur all varieties were spaced 18 inches prior to 1925 and 12 inches thereafter. At Big Spring the spacing has averaged about 14 inches, and at Dalhart about 12 inches. At the remaining Stations the spacing has been 12 inches for milo and 6 inches for the remaining varieties except in the one test at Beeville, results of which are shown in Table 11, in which all varieties were given a space of 9 inches.

Information concerning the best spacing of plants of different varieties has been obtained from experiments, the results of which have been published in Texas Station Bulletin No. 424. Desirable spacing for milo is 12 to 24 inches, for kafir it is around 6 inches, and for Hegari and feterita it is 6 to 12 inches. Desirable stands for kafir may ordinarily be obtained by planting at the rate of two pounds per acre, which yields approximately a six-inch stand. One pound of milo to the acre will produce an eighteen-inch stand under favorable conditions. Hegari and feterita seed do not germinate as well as those of many other varieties and to obtain desirable stands of these varieties two to three pounds of Hegari and three to four pounds of feterita seed are recommended. In South Texas, where thicker spacing is desirable, heavier rates must be used.

In these experiments much heavier rates of planting were used to insure good stands and thinning was done to obtain required stands.

#### Date of Planting

Planting has been done in these experiments at as nearly the optimum planting date for sorghums as possible. The planting at Lubbock has usually been done about May 15. At Chillicothe the yields are the average of three plantings made as near May 1, May 15, and June 1 as possible. At Spur there has usually been one planting about May 15. Single plantings have been made each year at Big Spring between May 15 and June 1; at Dalhart around June 1; at Iowa Park during early June; at Denton and Temple about April 15; at Beeville between March 15 and April 5; at Weslaco during March; at College Station about May 1; at Angleton during early April; and at Troup during April or early May.

These different dates fall in the optimum period for planting at each of the designated locations. Detailed results of date-of-planting experiments are also published in Bulletin No. 424.

#### Size and Arrangement of Plats

These variety experiments with grain sorghums have been conducted in field plats varying in size from 1/110 to 1/10 of an acre exclusive



Table 1. Summary of meteorological data from the stations at which these grain sorghum experiments were conducted.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Monthly Average	Annual
<b>Lubbock:</b>														
Rainfall, inches, 1911—31	.35	.81	.93	1.63	2.11	2.51	2.18	2.02	2.58	2.74	.63	.74		19.23
Mean maximum temperature	53.3	60.0	66.1	74.1	80.6	89.1	92.4	91.1	85.0	74.4	63.0	53.7	73.6	
Mean minimum temperature	24.8	28.9	34.2	43.4	53.0	61.8	65.1	63.7	57.7	46.7	34.4	25.9	45.0	
Mean mean temperature	39.1	44.5	50.2	58.8	66.7	75.5	78.7	77.5	71.3	60.5	48.7	39.8	59.3	
Av. rel. humidity, per cent	66.4	57.5	50.0	49.2	55.2	54.4	51.7	55.9	62.1	66.4	65.9	66.2	58.4	
Evaporation, inches	1.49	2.63	4.91	6.81	7.24	8.34	8.87	7.85	6.00	4.08	2.46	1.65		62.38
Wind run, miles	5368	5365	6974	6881	6495	6021	4836	4207	4501	4754	4701	4962	5417	
Frost-free period, days														208
<b>Chillicothe:</b>														
Rainfall, inches, 1906—31	.52	.76	1.45	2.48	3.22	3.34	2.54	2.47	2.53	3.48	1.41	1.13		25.33
Mean maximum temperature	52.0	58.7	66.5	74.9	82.3	92.4	96.0	94.8	87.6	75.6	63.9	53.5	74.9	
Mean minimum temperature	27.0	31.4	38.1	48.8	58.3	67.6	71.1	69.7	62.8	50.8	39.0	28.9	49.5	
Mean mean temperature	39.5	45.1	52.3	61.9	70.3	80.0	83.5	82.2	75.2	63.2	51.4	41.2	62.2	
Av. rel. humidity, per cent	69.2	62.0	56.6	55.0	59.5	56.4	53.7	55.4	61.2	66.0	66.2	68.6	60.8	
Evaporation, inches	1.97	2.91	4.95	6.61	7.98	8.77	9.43	8.78	6.51	4.39	2.75	2.02		67.07
Wind run, miles	4704	5132	6656	6378	5936	5191	4097	3614	3815	4000	4177	4607	4859	
Frost-free period, days														228
<b>Spur:</b>														
Rainfall, inches, 1911—31	.35	.72	.96	2.19	2.80	2.33	1.96	2.63	2.64	2.88	.85	.86		21.17
Mean maximum temperature	56.4	60.7	67.4	75.9	83.2	92.4	95.6	94.9	87.5	77.4	66.4	56.2	76.2	
Mean minimum temperature	26.2	30.7	35.8	46.0	54.7	63.6	67.3	65.8	59.1	48.1	36.3	27.6	46.8	
Mean mean temperature	41.3	45.7	51.6	60.9	69.0	78.0	81.4	80.3	73.3	62.8	51.4	41.9	61.5	
Av. rel. humidity, per cent	69.2	64.5	61.3	63.1	65.8	63.4	61.2	63.1	68.2	71.6	71.3	68.6	65.9	
Evaporation, inches	2.46	3.14	5.08	6.02	7.19	8.43	9.04	8.11	6.11	4.96	3.41	2.71		66.55
Wind run, miles	4410	4728	5581	5616	5622	4861	4352	3719	3865	4011	4278	4606	4637	
Frost-free period, days														215
<b>Big Spring:</b>														
Rainfall, inches, 1916—31	.54	.61	1.09	2.27	2.56	2.24	1.33	1.95	1.97	2.56	1.00	.56		18.61
Mean maximum temperature	55	62	68	76	83	92	95	94	87	76	65	56	75.8	
Mean minimum temperature	28	33	39	49	58	67	70	69	63	51	38	29	49.5	
Mean mean temperature	41	47	54	63	71	80	82	82	75	64	51	42	62.7	
Evaporation, inches				7.53	8.96	10.35	11.09	10.19	7.95					56.07
Wind run, miles	3848	3629	4018	4464	3720	3744	3348	2976	2952	2753	2952	3422	3444	
Frost-free period, days														222
<b>Dalhart:</b>														
Rainfall, inches, 1906—31	.22	.38	.77	1.90	2.81	3.06	2.55	2.81	1.50	1.72	.57	.51		18.80
Mean maximum temperature	48	52	59	68	77	87	91	89	83	71	58	48	69	
Mean minimum temperature	17	20	27	38	48	58	62	60	53	39	27	17	39	
Mean mean temperature	32	36	43	53	62	72	77	75	68	55	42	32	54	
Evaporation, inches				6.90	8.57	9.44	9.80	8.86	7.12					50.69
Wind run, miles	4836	4838	6250	6336	6101	4968	4613	4092	4320	4687	4608	4613	5022	
Frost-free period, days														177





of guard rows. At Iowa Park, Denton, Temple, Beeville, Weslaco, College Station, Angleton, and Troup the plats have been 1/110 of an acre and triplicated. At Lubbock the plats have been 1/55 of an acre and duplicated. At Spur the plat area has usually been 1/44 of an acre. At Chillicothe plat size has varied, being a single 1/42-acre plat on three different dates until 1930, since which time duplicate 1/84-acre plats on three dates have been used. Duplicate plats of 1/10 to 1/25 acre in area have been used at Big Spring and at Dalhart 1/10-acre plats duplicated until 1929 and 1/20-acre plats duplicated on three dates since 1929.

Row width has been 36 inches at all Stations except at Chillicothe, where the width was 40 inches, and at Dalhart and Big Spring, where it was 44 inches.

It has been the general practice to protect the crops in the plat areas from unequal competition by the use of guard rows.

### Planting and Cultivation

The methods of soil preparation, planting, and cultivation at each Station have been those accepted as good farm practices in the particular region involved. Cultivation has been uniform each year over the area of each experiment. Thinning has been done when the plants were 3 to 6 inches tall.

### Methods of Obtaining Data

Grain yields have been obtained ordinarily by heading the crops with a pocket knife, allowing the heads to dry, and then threshing the entire head production of the plat. Grain yields are presented in bushels of 56 pounds. Forage yields are air-dry weights in all instances, are presented in tons, and are obtained by adding the production of air-dry heads to that of air-dry stover. Various methods have been resorted to in an effort to obtain accurate air-dry forage weights and at each Station the best method possible, considering the available equipment, has been used. At Chillicothe the method used since 1928 has been to take a representative sample of green forage from each plat as harvested and dry this sample beyond the point of air-dry moisture content in a forage drier that uses natural gas as a source of heat. After drying, these samples are hung under a shed to take up moisture until air-dry, and when all harvesting is completed, and after several days of dry weather, all samples are weighed. Shrinkages are then calculated and air-dry stover and forage yields computed.

The number of days from planting to full boot and to maturity are, respectively, the number of days from planting until 50 per cent of the heads were in full boot and until 90 per cent of the heads had matured their seed.

The measurement and observation of plant character such as height, diameter of stalk, and number of leaves were made at maturity and the figures shown are the average obtained from ten consecutive plants in

the row. Height of plant was measured from the surface of the ground to the tip of the head. Diameter of stalk is the average of three measurements—one made at the base, one at the middle, and one at the peduncle of the plant. Exsertion of the head was measured as the length of the peduncle exposed above the flag leaf. In obtaining the count for the number of leaves, only those leaves were counted which had reached full development. Some of the basal leaves which were counted, particularly in adverse seasons, were dead at the time the counts were made. The number of stalks to the plant was obtained by counting the number of stalks present in ten plants and dividing by 10.

Threshing percentage was obtained by dividing the weight of clean, threshed grain by the weight of air-dry heads and multiplying by 100. Test weight per bushel was taken at threshing time just as the grain came from the thresher.

#### Method of Obtaining Comparable Yield

In the conduct of the experiments reported herein, it has been the policy to try new varieties as they have appeared and, on account of the multiplicity of varieties, it has been necessary to discontinue growing some varieties after their comparative worth had been determined. At Lubbock, Chillicothe, Spur, Beeville, Big Spring, and Dalhart not more than two to six varieties have been grown continuously for the period of years for which yields are reported. Since there is no long period of years common to many of the varieties, the average yields are not a fair basis of comparison. In order to present the yields of the different varieties on as nearly a comparable basis as possible the following method has been used in calculating an average percentage rating and a comparable yield.

Varieties which were grown for the entire period were considered as "standard," or check, varieties and the average yield of these varieties in any year is considered to be the yield of the standard, or check, varieties for that year. The percentage rating of any particular variety was computed by dividing the total production of this variety by the total average production of the "standard" varieties for the same years and multiplying by 100. This percentage rating is, therefore, based on the behavior of the particular variety in question as compared to that of the "standard" varieties in the identical years when each was grown. For convenience in comparing the production of different varieties, since one ordinarily thinks of yield in terms of bushels or tons instead of percentages, a yield figure called "comparable yield" has been computed. This figure was obtained by multiplying the average production of the "standard," or check, varieties for the entire period by the percentage rating of each variety. Therefore, the percentage rating and the "comparable yield" figure are equivalent to each other, one being expressed in percentage and the other in bushels, calculated upon the performance of the standard varieties throughout the whole period of years. These calculated yields allow all the varieties to be compared

in terms of bushels per acre and for this reason are used as the basis of discussion of the yields throughout this Bulletin.

### DESCRIPTION AND HISTORY OF VARIETIES

A brief history of the more important varieties of grain sorghums, together with a general description of the plant characteristics and growth habits of these varieties, is outlined below. Such characters as height of plant and length of growing season will vary somewhat from year to year, or in different localities, but long-time averages of the various observations and measurements will be found in Table 2. No botanical classification has been included.

#### Milo

The milos have a compact, elliptical head, normally borne on a recurved peduncle, have slender, pithy stalks bearing 12 leaves, tiller freely, and mature in 95 to 110 days.

**Yellow Milo:** Strains representing three heights of plant are commonly grown and known as Standard, Dwarf, and Double Dwarf (Fig.5). Standard grows 5 to 6 feet, Dwarf 3 to 4 feet, and Double Dwarf 1½ to

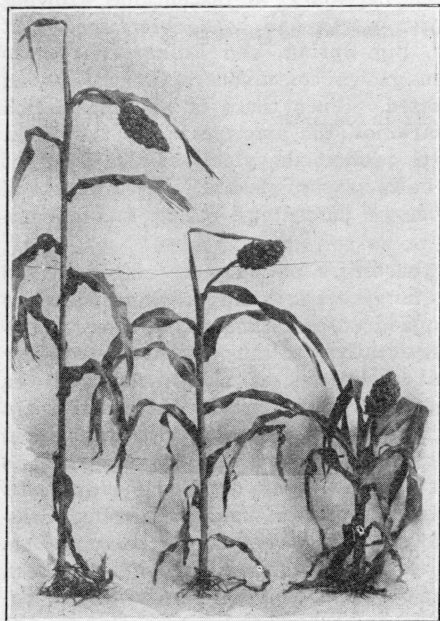


Fig. 5. Three statures of Yellow milo commonly grown in Texas. Standard, Dwarf, and Double Dwarf varieties (left to right).

2½ feet tall. Standard milo is the original strain introduced into this country about 1880 and a few years later appeared in Texas, where it was the only milo grown until about 1906. It is still grown to a small extent in the High Plains but has been practically replaced by Dwarf Yellow milo, which undoubtedly originated by mutation from Standard milo.

A field of this dwarf strain was grown by Judge J. F. Bradley, at Memphis, Texas, in 1906, and arrangements were made for obtaining a supply of this seed for general distribution to farmers by A. B. Conner, Superintendent of the Chillicothe Forage Crops Testing Station, operated by the Office of Forage Crops Investigations and the Texas Experiment Station. Dwarf Yellow milo soon thereafter became the most important variety grown. In more recent years pure strains of Dwarf milo have been widely distributed by the Texas Station. Double Dwarf Yellow milo is a double recessive for height

and may have originated as a mutation in Dwarf milo or as a recombination product of two different dwarf strain mutations from Standard. Its place of origin is unknown but it appeared in the Imperial Valley of California before 1916 and has been grown in Texas at least since 1918. There are apparently several strains of Double Dwarf milo in existence. This variety is grown to some extent in regions of the State where Dwarf milo grows taller than is desirable.

**White Milos:** The same three heights that occur in Yellow milo exist also as white varieties: Standard, Dwarf, and Double Dwarf. The origin of Standard White milo is unknown but it probably originated as a recessive mutation from yellow to creamy white seed color, and was growing in Northwest Texas prior to 1910. Dwarf White milo is a double recessive that apparently originated by recombination from a cross between Standard White and Dwarf Yellow milo. This variety is, for all practical purposes, an exact counterpart of Dwarf Yellow except for seed color and associated plant color. Dwarf White milo was first grown on the Lubbock and Chillicothe Stations in 1916, where it was obtained from farmers and probably came, originally, from northern Texas or southern Oklahoma. Double Dwarf White milo was developed at the Lubbock Station in 1925 as a double recessive from a hybrid between Dwarf White and Double Dwarf Yellow milo. In addition, there is an Early White milo, somewhat earlier than other milos and between the Dwarf and Standard varieties in height, that appeared about 1911 and has been grown at the Chillicothe Station since that time. It has subsequently been called 60-day and 90-day White milo, and before the advent of the true Dwarf White milo, it was known under that name, which fact is responsible for the general belief on the part of many that White milo is earlier than Yellow milo. Recently early yellow strains have also been developed through hybridization between this milo and yellow varieties.

### Kafirs

Kafirs are straight-headed, have stout stalks, numerous leaves, overlapping sheaths, generally juicy and somewhat sweet stalks, a tendency not to lodge or to sucker, and have a relatively long growing period. Kafirs were first introduced into the United States in 1876 but were not grown extensively until introduced into the Great Plains region about 10 years later. New varieties of kafir have been appearing from time to time through selection. The Blackhul kafirs and varieties derived from them have white seed and black glumes. Whitehul kafir has white seed and straw-colored glumes. Red and Pink kafirs are named for the color of their seed and have reddish glumes that fade to straw color at maturity.

**Standard Blackhul kafir** grows 5 to 6 feet tall, has about 16 large leaves, and matures in 120 to 130 days. The original Standard Blackhul kafir that was once widely grown has, in Texas, been replaced largely by earlier and more dwarf forms.

**Blackhul kafir 153** is a pure line selection of Standard Blackhul kafir developed and distributed from the Lubbock Station in 1920 (Fig. 8).

**Texas Blackhul kafir** is a pure line selection of Blackhul that is intermediate in height between Standard and Dwarf, has a slender stalk with 15 leaves, and is as early as Dawn kafir. This is a desirable pure line variety of kafir developed and distributed from the Lubbock Station in 1925 (Fig. 7).

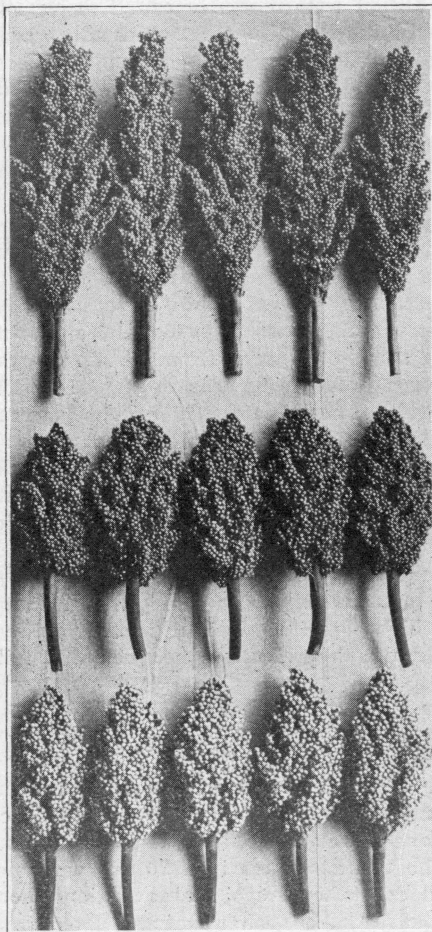


Fig. 6. Typical heads of Dawn kafir (top), Dwarf Yellow milo, and Spur feterita (below), three of the best varieties of grain sorghums for Texas.

**Dawn kafir** arose at the U. S. Field Station at Amarillo, Texas, in 1907 and was selected by A. H. Leidigh in the progeny of what was apparently a kafir-sorgo hybrid. This variety was at one time the principal kafir grown in Texas and is commonly known as Dwarf kafir (Fig. 6), Dwarf Blackhul, and Santa Fe kafir. It grows from 3 to 4 feet tall, has 14 leaves, small seed, and matures in 110 to 115 days. Because of its hybrid origin this variety is not typical of Blackhul kafir in all respects. For 20 years this has been an excellent variety of kafir grown extensively in western Texas, particularly on the High Plains, until a recent epidemic of kernel smut reduced the supply of pure, disease-free seed to such an extent that the acreage originally devoted to this variety was replaced largely by Texas Blackhul. This shift in varieties illustrates the necessity of maintaining an adequate source of pure, disease-free seed in the perpetuation of a variety.

**Sunrise kafir** arose in the same progeny that produced Dawn kafir. This variety is distinct from pure kafir in several respects, including a difference in head shape and a tendency to produce more suckers. It grows 5 to 7 feet tall, has about 14 leaves, and a slender, juicy, sweet stalk. Sunrise kafir, which matures in 110 to 115 days, is one of the earliest of the kafirs.

**Whitehul kafir** was one of the original kafir varieties introduced in 1876.



The variety is the earliest of the kafirs and grows 3 to 4 feet tall. It has disappeared from general cultivation, since it has the undesirable characteristic of failing to exert completely from the boot.

**Reed kafir** originated in the hands of W. N. Reed, Elk City, Oklahoma, about 1918. It is not a true kafir but resembles the kafirs quite closely and is probably a kafir-sorgo hybrid. The glumes are large and black and all of the seed do not thresh from the glumes. The variety matures in about 110 days and is earlier than Standard Blackhul. It grows 4 to 5 feet tall and has 14 to 16 leaves, which have a tendency to break down and hang vertically about the stalk after maturity.

**Red kafir** is another of the original kafir introductions of 1876. The original Red kafir, T. S. No. 46, is late, has about 16 leaves, has quite sweet, juicy stalks, and grows about 4 to 5 feet tall. This Red kafir at one time was grown extensively for bundle feed by ranchmen in western Texas. In recent years an early Red kafir, T. S. No. 17485, with pithy stalks and a tendency to sucker, has been distributed from the Experiment Station at Hays, Kansas.

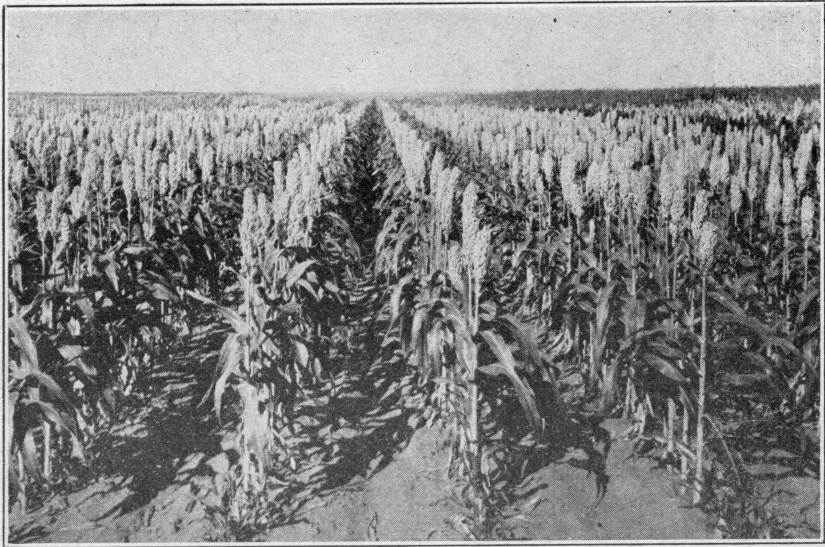


Fig. 7. Texas Blackhul kafir, the most widely grown kafir in Texas, selected and distributed from the Lubbock Station, showing the uniformity and high yield (50.2 bushels per acre) of this variety at Chillicothe in 1927.

**Pink kafir** is another of the original kafir introductions. The late variety, T. S. No. 45, is much like Red kafir, T. S. No. 46, except that it is somewhat later, has larger stalks, a large bushy head, and has pink seed. It is capable of making unusually large yields of grain when grown under good conditions. There is also an Early Pink kafir, T. S. No. 3295, which has a slender, pithy stalk, and a tendency to sucker.

This early strain, distributed from the Hays (Kan.) Station, is much grown in western Kansas.

Rice kafir is of unknown origin but types similar to this variety in seed characteristics may be obtained from the progeny of kafir x Sumac hybrids. The variety is late, has numerous and large leaves, and pearly-looking seed that give the variety its name. This variety is of relatively little importance but is grown to some extent in the deep, sandy soils in the southeastern part of the Panhandle.



Fig. 8. Field of Blackhul kafir 153 grown at the Chillicothe Station in 1926, showing the uniformity of growth from pure line seed. Yield: 48 bushels to the acre.

#### Feterita

Feterita was grown at the Chillicothe Station in 1907 from seed introduced into the United States by the Office of Forage Crops from the Sudan region of Africa. Feteritas are early, have a tendency to sucker, have erect, rather loose heads, and large, white seed which are inclined to shatter. There is a brown nucellar layer present beneath the white pericarp of the seed, and in the presence of this undercoat, white seed have a characteristic chalky appearance. The midrib of the leaf is broad and white, indicating a pithy stem.

Standard feterita is the original introduction, grown and distributed from Chillicothe. The variety grows 5 to 6 feet tall, is inclined to lodge, has slender stalks, few leaves, and the plants sucker more than other strains, except T. S. No. 2840. This early variety matures in 90 to 100 days.

Spur feterita originated at the Spur Station and was the best of a large number of selections made from the Standard variety in 1914. Spur

feterita is about a week later than Standard, has shorter and stouter stalks, has 14 to 16 leaves, and has a larger and more compact head (Fig. 9).

Dwarf feterita, T. S. No. 5985, originated from the same lot of selections as Spur feterita and is like that variety except that it is earlier, maturing in about 95 days, and is dwarf, growing 3 to 4 feet tall (Fig. 10).

In addition, there is a feterita which is designated in the tests at Chillicothe as T. S. No. 2840 (F. C. 811) that arose from a later importation from the Sudan region than that of the Standard variety. This variety is earlier, more slender-stemmed, and has a greater tendency to sucker than Spur feterita. The variety is considerably shorter than the Standard variety and about the same as that variety in length of growing season.

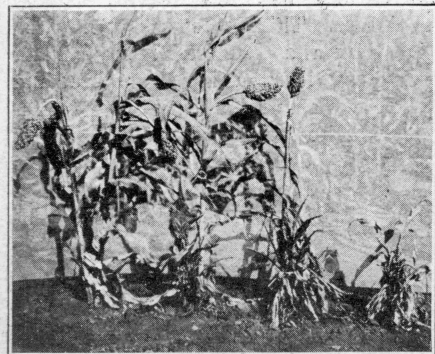


Fig. 9. Showing damage to milo plants by chinch bugs and disease. (Left to right) a normal, healthy plant; a plant that recovered to produce one good head; plant making only a partial recovery; and plant that failed to recover from attack. Note bunching growth on plants at right, typical of severe damage and loss in milo from this disease.

### Kaoliangs

The kaoliangs are native to China, and even though they were grown in America as early as 1865, they have never been important crops here. The varieties which were on trial in the experiments reported here are only a few of the types that have at one time or another been introduced. The kaoliangs are characterized by slender, pithy stalks that dry in the field shortly after maturity, relatively few leaves, and glumes that are almost entirely glabrous. Most of the kaoliangs are quite early in maturity. No variety of this group of sorghums has ever been of importance in Texas.

### Miscellaneous

Hegari was first grown at the Chillicothe Station in 1908 from seed imported from the Sudan region of Africa by the Office of Forage Crops. The plants of this variety ordinarily grow to a height of 3 to 5 feet (Fig. 11). Diameter of stalk varies considerably, depending upon the season and the locality grown, but ordinarily the stems are coarse. The variety tillers profusely and has numerous, large leaves. The heads are erect and the seeds are chalky-white with a brown undercoat. The variety is erratic in its behavior from year to year and from one section of the State to another. At the time of distribution of the crop, Hegari was considered to be an early variety but it is now known to be late or early, depending upon conditions. At Chillicothe, it is one of the latest

varieties grown; at Lubbock it is ordinarily earlier than Standard Blackhul kafir, while at Beeville, Hegari is known as an early variety.

**Chiltex** is a dwarf, early, straight-headed variety having chalky-white seed with a brown undercoat. The variety has few leaves, usually 8 to 10, and grows to a height of 3 to 4 feet. This variety is a selection from a feterita-Blackhul kafir hybrid resulting from breeding work undertaken at the Chilli-cothe Station by H. N. Vinall, of the Division of Forage Crops and Diseases, United States Department of Agriculture. Chiltex was increased and distributed to farmers in 1923.

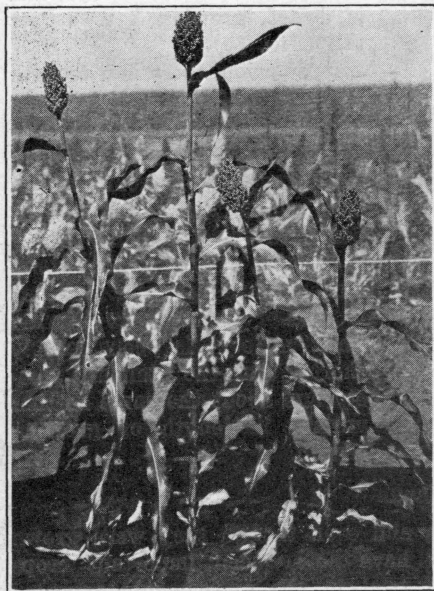


Fig. 10. Typical plants of Spur feterita (left) and Dwarf feterita (right) developed at the Spur Station. These two varieties have replaced the Standard variety originally grown.

**Schrock** is a selection from a hybrid which was of unknown parentage, but which was probably kafir and some sorgo. The selection was made by Roy Schrock, of Enid, Oklahoma, in 1912. The variety grows 3 to 5 feet tall, suckers moderately, is medium late, straight-headed, and brown-seeded (Fig. 12); and like Darso, the seeds are bitter, on account of their high tannin content. The name of Sagrain has been given to a selection from Schrock, which is practically identical with the parent variety. Schrock is characterized also by having a waxy endosperm, the starch reserve staining red with iodine, whereas the non-waxy starch in the endosperm of other common varieties stains blue. Sagrain seed also have a waxy endosperm.

**Premo** originated at the same time as Chiltex and was selected from the same feterita-kafir hybrid. The variety is about the same in length of growing season as the earlier kafirs. It has numerous leaves and suckers moderately. The heads are large and erect with poor exertion. The seeds are chalky-white with a brown undercoat.

**Darso** was distributed by the Oklahoma Experiment Station in 1914 and is apparently a hybrid between sorgo and kafir. The variety is dwarf, 3 to 4 feet, has numerous leaves, juicy stalk, and the plants sucker but little (Fig. 13). The heads are long and loose and the seeds are reddish-brown and have a bitter taste because of high tannin content. This variety has been grown in Texas since 1916 and is of most importance in the eastern part of the State.

Shallu was introduced from India in the early 1890's, was first grown in Louisiana, and from there spread west into Texas. It has never assumed much importance in this State. It is late in maturity and grows to a height of 5 to 7 feet. The variety tillers freely and there is a tendency for the stalks to lodge and also for the seed to shatter badly at maturity. The heads are loose and the seeds are cream-colored.

Freed has white seed and slender, sweet, and juicy stalks, which grow to a height of 5 to 6 feet and have 8 to 10 leaves. It is not grown to any extent in Texas.



Fig. 11. Hegari, originally introduced and selected at the Chillicothe Station, produces a heavy yield of grain and forage under good conditions. This variety is more dependable in South and Central Texas.

Fargo was discovered growing in Northwest Oklahoma in 1921. It is likely that this variety is one of several selections from a milo-kafir hybrid that were distributed by Mr. H. Willets Smith of Garden City, Kansas, about 1912. The variety is late, grows 5 to 7 feet tall, has a coarse stalk, and has seed the color of Yellow milo.

#### OTHER CHARACTERISTICS OF VARIETIES

Measurements and observations of plant characters have been made on varieties at Lubock in most years during the conduct of the variety experiments. All of the measurements and observations shown in the table were not recorded each year but, as indicated below, the averages for the various plant characteristics, in most cases, cover a period of 10

to 15 years. To determine exactly the number of observations that make up any given average figure in Table 2 it is only necessary to note from Table 4 in which years the variety was grown and in which years measurements were taken on the various characters.

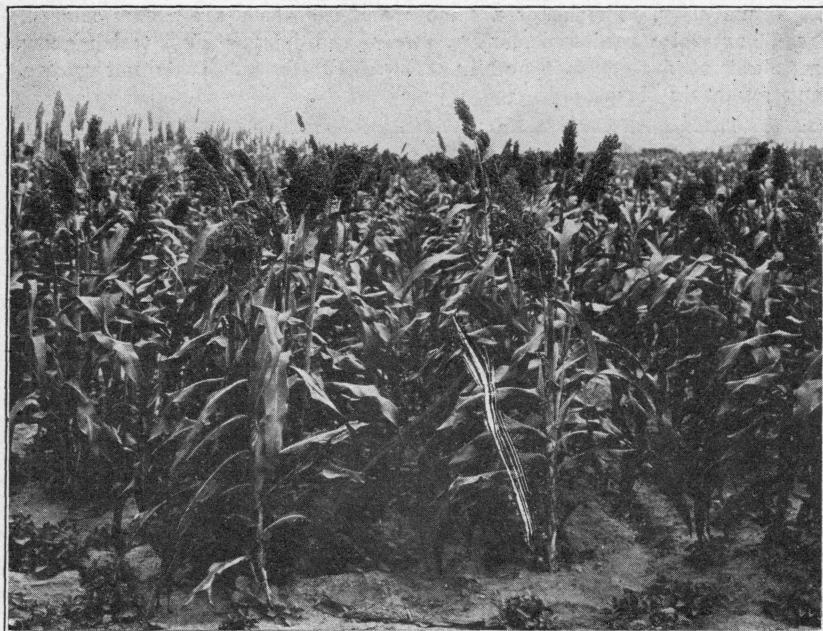


Fig. 12. Showing the growth habit of Schrock, a good forage- and grain-producing variety for the humid region of eastern Texas.

Data on length of period from planting to full boot were taken from 1917 to 1931, inclusive; observations on days from planting to maturity were made from 1915 to 1931, inclusive, excepting 1917; measurements on height of plant were made from 1916 to 1931, inclusive; diameter of stalk was measured from 1918 to 1931, inclusive, excepting 1920; head exertion was measured from 1922 to 1931, inclusive; number of leaves per stalk were counted in 1915, 1918, 1919, 1921, and 1922; number of stalks to plant was counted from 1922 to 1931, inclusive; threshing percentages were calculated from 1916 to 1931, inclusive, excepting 1926; and test weights were taken in 1920, 1922, 1924, 1925, and 1928 to 1931, inclusive.

A summary of these measurements and observations is recorded in Table 2 and the averages show the typical behavior, habit of growth, and other plant characters for the various varieties. Most of these characteristics have been mentioned in the previous description of varieties but records of the threshing percentage and the test weight per bushel were not discussed there.

Table 2. Plant characters of grain sorghum varieties. Averages of number of days to full boot and to maturity; of height of plant, of diameter of stalk, and of head exertion at maturity; of number of leaves and of stalks per plant; of threshing per cent; and of test weight per bushel at Lubbock.

T. S. No.	Variety	No. of days from planting to		At maturity			No. per plant		Threshing %	Test weight pounds per bushel
		Full boot	Maturity	Height of plant, inches	cm.		Leaves	Stalks		
					Diameter of stalk	Exertion of head				
<b>Milo:</b>										
672	St. Yellow	67	103	53	1.4	9	12	1.7	72	55
1645	St. White	67	103	52	1.4	8	12	1.9	76	56
670	Dwarf Yellow	68	104	36	1.6	6	12	1.9	72	56
3296	Dwarf White	68	100	38	1.5	6	12	1.9	73	56
8728	Double Dwarf Yellow	68	101	20	1.5	1	---	2.1	68	55
1926	Early White	63	101	55	1.3	6	10	1.7	74	56
<b>Kafir:</b>										
6819	St. Blackhul	94	131	45	2.0	-2	16	1.3	76	57
6022	Blackhul 153	90	127	47	1.9	2	17	1.2	72	56
6818	St. Blackhul	95	132	46	2.0	2	16	1.3	72	56
674	St. Blackhul	82	118	52	1.9	---	16	1.3	74	58
1927	Blackhul	88	119	52	2.1	---	17	1.3	70	56
9195	Texas Blackhul	75	111	43	1.6	6	15	1.2	76	57
673	Dawn	76	113	39	1.7	2	14	1.3	73	57
1939	Sunrise	72	113	54	1.4	5	14	1.7	76	58
1920	Whitehul	70	107	42	1.7	-5	12	1.1	74	57
6824	Reed	80	109	46	1.8	0	---	1.2	72	57
46	Red	87	124	47	1.8	2	16	1.2	71	56
45	Pink	90	136	50	1.9	-2	17	1.2	70	56
3295	Early Pink	87	120	47	1.9	0	16	1.1	73	56
3682	Rice	89	132	56	1.8	1	16	1.5	73	53
<b>Feterita:</b>										
1652	Standard	67	96	53	1.5	3	12	1.5	73	55
3232	Spur	69	103	47	1.7	3	15	1.4	71	53
5985	Dwarf	67	96	37	1.5	2	14	1.3	71	55
3231	Leafy	74	108	50	1.6	4	17	1.7	71	52
<b>Kaoliang:</b>										
1934	Brown	88	112	52	2.4	---	15	1.1	70	48
1935	Brown	67	106	56	1.6	3	11	1.6	71	57
1936	Red	67	102	57	1.3	---	8	---	73	53
<b>Miscellaneous:</b>										
7313	Hegari	80	114	40	1.5	0	12	2.1	71	55
6823	Chiltex	68	99	37	1.6	4	13	1.5	72	53
6820	Premo	74	106	36	1.9	1	15	1.3	70	56
2897	Darso	77	110	42	1.8	1	16	1.1	73	57
1923	Schrock	73	115	45	1.6	3	14	1.5	67	54
1653	Shallu	86	130	66	1.5	6	15	2.6	67	59
41	Freed	53	93	64	1.2	---	9	---	80	51
1654	Acuff	80	111	39	2.2	---	14	---	67	51

### Threshing Percentage

During the years of the experiments at Lubbock, 348 threshing percentages have been computed involving 35 varieties. The average threshing percentage of the 348 tests was 72.1. The average shelling percentage for all milos was 72.5, and was 73.0 for the kafirs. These threshing percentages should be quite representative of what may be expected of the grain sorghum varieties and apparently the different groups or varieties do not differ much in shelling percentage. The milos, kafirs, feteritas, and varieties included in the miscellaneous group, each average close to 72 per cent of grain to the head. There is considerable variation, however, from year to year, depending upon how favorable the season is to grain production, filling of the heads, and maturity. In 1917, an unfavorable year, for instance, the average shelling percentage for all varieties was 62, while in 1921 it was 80. Varieties in these tests have threshed as low as 50 per cent grain in some years and as high as 85 per cent grain in others. A threshing percentage of 72 can be considered about the normal average for grain sorghums. Threshing percentages at Chillicothe have been about 5 per cent below those at Lubbock during the past 8 years. During three years of these eight, however, the percentages have been unusually low at Chillicothe due to drought conditions that reduced the size of the grain while head size was not greatly reduced.

### Test Weight per Bushel

A total of 126 records on test weight per bushel was obtained at Lubbock over a period of eight years and included records on 35 varieties. The average test weight for all varieties was 55.3 pounds. For the milos it was 55.7 pounds; for the kafirs, 56.4 pounds; and for the feteritas, 53.8 pounds. At Chillicothe the average of 114 records on 15 varieties, over an eight-year period, has been exactly 56 pounds per bushel. Variation in test weight per bushel depends largely upon the completeness of threshing from the glumes. The test weight is likely to vary from 52 to 59 pounds, but when threshed clean the seed will usually weigh close to 56 pounds to the bushel.

### Percentage of Grain in Forage

It is important in the feeding of livestock to know the amount of grain contained in the forage. In Table 3 is a summary of the percentage of grain in the forage of grain sorghum varieties at Chillicothe during the years 1924 to 1931, inclusive. The average figures shown for the milos are not reliable, since milo has been severely damaged by chinch bugs in each year for which results are given except 1924 and 1931. Ordinarily about 40 per cent of milo forage is grain. The percentage of grain in the kafirs varies from 25.3 to 31.6 and average 28.1. Spur feterita forage averages about 28 per cent grain. There is about 4 per cent more grain in Dwarf than in Spur feterita forage because of the much smaller stover production of the former variety. Chiltex and Darso have relatively high grain ratios because of their high grain production and relatively low stover production.



Hegari has the lowest grain percentage of any of the 15 varieties shown because of its very high stover production and its low yield of grain since 1928.

At Lubbock, records on percentage of grain to total plant in 1928 and 1929 show the following percentages: milo, 35.0; Blackhul kafirs, 28.5; and feteritas, 29.5. The percentage of grain to total plant for Double Dwarf Yellow milo, for the same two years, is 45.4. Dwarf varieties and early varieties, in general, produce a higher percentage of grain to total plant than the taller or the later varieties.

Table 3. Percentage of grain in the forage of grain sorghum varieties at Chillicothe, 1924—31.

T. S. No.	Variety	Percentage of grain in total plant								
		1924	1925	1926	1927	1928	1929	1930	1931	Average
	<b>Milo:</b>									
43	Dwarf Yellow	41.6	21.8	34.2	29.3	19.9	18.1	21.6	23.9	26.9
4061	Dwarf White	43.0	22.9	31.2	22.7	13.3	20.0	16.7	30.5	25.0
	<b>Kafir:</b>									
9195	Texas Blackhul				30.7	26.8	27.8	10.1	31.9	25.5
3295	Early Pink		31.5	38.4	32.1	29.5	28.1	17.3	32.3	29.9
17485	Early Red	39.2	32.0	34.1	32.8	31.0	27.0	22.9	33.7	31.6
6022	Blackhul 153	32.3	30.8	31.7	31.5	24.5	25.2	2.5	24.2	25.3
6824	Reed	39.2	28.1	33.9	32.3	31.0	24.0	11.2	23.4	28.5
1927	Blackhul	32.7	31.9	34.8	33.7	26.0	24.9	8.3	29.3	27.8
	<b>Feterita:</b>									
3232	Spur	36.7	31.6	33.7	33.1	22.7	30.3	7.5	23.5	28.0
5985	Dwarf	38.5	31.2	34.2	35.3	25.6	31.7	25.1	33.5	31.9
	<b>Miscellaneous:</b>									
2897	Darso	41.4	33.7	34.0	36.2	31.2	29.7	29.0	37.9	34.1
6820	Premo	38.8	30.0	36.6	31.9	32.0	22.6	13.6	32.5	29.8
6823	Chiltex	43.8	29.6	41.5	42.1	32.9	26.6	22.0	38.5	35.3
1942	Hegari	26.3	26.2	28.5	24.7	16.8	9.3	2.5	13.9	18.5
8967	Fargo	36.3	23.6	39.3	24.6	19.5	12.8	8.3	23.5	23.5

## YIELDS OF GRAIN SORGHUM VARIETIES

### Results at Lubbock

Substation No. 8 is located three miles east of Lubbock in the High Plains Region of Texas and near the center of what is known as the South Plains. The altitude is 3106 feet above sea-level. The average rainfall over a period of 21 years is 19.23 inches, 82 per cent of which falls between the months of April and October, inclusive. The average dates of the last killing frost in the spring and the first in the fall are April 9 and November 2, respectively. The optimum date of planting sorghums in this section is from May 15 to June 15, and when planted at that time sorghums mature between the middle of August and the first of October, depending upon the variety and seasonal conditions. The soils on this Station are fine sandy loams of the Amarillo and Richfield series and are typical of much of the South Plains.

Insects have not been particularly destructive to sorghums at Lubbock; however the corn ear worm (*Heliothis obsoleta*) occasionally does some damage to compact-headed varieties. Kernel smut may be destructive if disease-infected seed are used but infection in the field rarely occurs. The disease is easily prevented by the use of copper carbonate or Ceresan at the rate of 2 to 3 ounces to the bushel of seed.

In computing the average percentage rating and comparable yields

in Table 4, Dwarf Yellow milo, Standard White milo, Standard Yellow milo, Pink kafir, Dawn kafir, Red kafir, and Standard feterita were used as standard, or check, varieties. Yields are shown for the year 1912 but the results of this year were not used in obtaining any of the averages.

It is evident from the results obtained with 35 varieties which have been grown for three or more years during the period 1912 to 1931, inclusive, (Table 4) that it is important to grow adapted varieties. Comparable yields of varieties in the milo group varied from 24.9 to 30.8 bushels, and in the kafir group they varied from 20.5 to 32.0 bushels. Less variation occurred in grain yield among the feterita varieties than in any of the other groups.

There was no significant difference in the yields of Dwarf Yellow, Dwarf White, Standard Yellow, and Standard White varieties of milo. Double Dwarf Yellow has yielded below the other varieties mentioned and the difference of 2 to 3 bushels is probably a real one. Early White milo matures in too short a time to take full advantage of favorable conditions in good years and consequently has produced less than the regular milos.

Texas Blackhul is the most valuable variety of kafir for grain and forage production (Fig. 7). Sunrise kafir is a good forage variety. The remaining kafir varieties are not as well adapted or have nothing in particular to recommend them over Texas Blackhul, Dawn, Reed, and Sunrise. Dawn, or Dwarf kafir, which has been an important variety in this region for many years because it is more certain of production in dry years than many of the kafirs, has consistently yielded less than Texas Blackhul; and the latter variety is replacing it to a marked degree.

Standard feterita has yielded 29.4 bushels and the yields of Spur and Dwarf are, respectively, 27.7 and 27.2 bushels. Standard feterita is early in maturity and is reliable in dry years as is evidenced by its higher yields in 1922, 1924, and 1929. Spur feterita is a heavier producer of forage but is not as reliable as a grain producer in dry years. Dwarf feterita is early, certain of production, and valuable for late planting. The kaoliangs are not desirable under the conditions here, as they are poor forage varieties, are not heavy grain producers, and lodge badly. Shallu has produced more grain than any other variety in the trials at Lubbock, largely on account of unusually high yields in a few years, but this variety has several characteristics that make it undesirable. The seed shatter badly at maturity, the stalks lodge, and the plants grow too tall for easy harvesting.

The grain yield of Chiltex has been 26 per cent above that of the standard varieties. It is strictly a grain-producing variety and is reliable in dry seasons, but produces low yields of forage, which is of excellent quality. Premo has produced 16 per cent better than the standard varieties and is a fair forage variety.

Darso has been above the average of the standard varieties in production but there is nothing in particular to recommend it for general planting under conditions at Lubbock, particularly as the seeds of this variety are not palatable to livestock.



Schrock, like Darso, has produced slightly more grain than the standard varieties but the seeds are high in tannin content and the variety is not desirable for general planting under the conditions here.

There is no justification for growing Freed in Texas except where the rainfall is very low. The variety is extremely early and under usual conditions the yield is not as large as that of the better varieties.

Hegari has made disappointing yields in the test at Lubbock and has produced 15.5 per cent less grain than the "standard," or check, varieties. Hegari is notoriously erratic in its response to moisture conditions, and occasionally makes large yields, but in this test its yield was consistently below the check varieties in each of the 13 years it was grown except 1925 and 1928. This variety produces a large yield of stover. In the hands of farmers Hegari occasionally makes exceptionally good yields but when conditions are not exactly right for this variety it not infrequently makes a complete failure in this region.

### Results at Chillicothe

Substation No. 12 is located in the eastern part of Hardeman County, five and one-half miles southwest of Chillicothe. The altitude is 1406 feet above sea-level. The average annual rainfall over a period of 26 years is 25.33 inches, of which 79 per cent falls between the months of April and October, inclusive. The average dates of the last killing frost in the spring and the first in the fall are March 25 and November 8, respectively. The soils in this, the Rolling Plains region, have been developed from the Red Beds formations and on the Station farm are fine sandy loams, loams, and clay loams.

The range of the optimum planting period at Chillicothe is longer than that at most of the other western Stations, due to the difference in altitude, the greater variability in growing conditions from year to year, and the heavier type of soil at Chillicothe. Planting may be done at any time between April 15 and June 15 with reasonable assurance of success. Milo, however, should not be planted between May 10 and June 10 on heavy types of soil in this section. Chinch bugs, with perhaps an associated plant disease, have consistently reduced yields of milo in May 15 and June 1 plantings since 1925 except 1931. The extent of the damage has varied from year to year, but in several instances complete failure has resulted. Plants are usually attacked in June when only a few inches high. The bud frequently rots, and suckers and side branches develop, which are in turn attacked, producing a dwarf bunch-like appearance of the plants and results in a crop failure (Fig. 9). It has been observed that early plantings made in April and late plantings made after about June 10 escape this damage almost entirely. Also, damage has been severe on clay loam or heavier types of soil and less severe on sandy types. As long as the loss from this cause exists, milo should not be planted on heavy soils during the period from May 10 to June 10 in this section of the State if chinch bugs are prevalent. The sorghum midge has, on rare occasions, been present but the damage has never been

appreciable. Corn ear worms are present in many of the maturing heads each year but no measure of the damage done is available. The heads of erect-headed varieties that have a compact base sometimes become moldy and dirty inside on account of the collection of excrement. Heads with a loose base are not subject to this damage. Clean seed must be used to prevent damage from kernel smut, and if this precaution is taken, infection rarely occurs. Red spot is present every year and occasionally, in wet seasons, damages the forage to some extent.

Blackhul kafir (T. S. No. 1927), Spur feterita, and Hegari were used as the standard or check varieties at Chillicothe. Dwarf Yellow milo was not used, because of the insect and disease damage suffered by that variety in recent years. Spur feterita was not grown until 1919 and prior to that time the yields shown for that variety are those of Standard feterita, T. S. No. 1652.

Most common varieties of grain sorghum are adapted to conditions at Chillicothe (Tables 5 and 6). During recent years, since milo has been damaged by chinch bugs, the kafirs have been producing the highest yields. The feteritas have produced consistently but have failed to take full advantage of favorable seasons and the average yields are below those of the best kafir varieties.

The percentage rating of Early White milo is higher than that of Dwarf Yellow milo but Early White milo has not been grown since damage from chinch bugs has been encountered. It is susceptible to chinch bug attacks also, and had it been grown, its percentage rating would probably have been lowered.

Texas Blackhul, Blackhul 153, Early Pink, Early Red, and Reed kafir have all made good grain yields at Chillicothe, and each has a percentage rating of at least 12 per cent above that of the standard varieties.

Of these five varieties, Blackhul 153 has produced the most forage (Fig. 8), followed by Texas Blackhul, Reed, and Early Pink, in the order named. From the standpoint of both grain and stover, Blackhul 153 and Texas Blackhul are probably the most valuable varieties.

Feterita 811 has the best percentage rating among the feterita varieties, but it is not certain that its apparent production above that of Spur feterita is real. Feterita 811 produces forage of excellent quality but somewhat less than the Spur variety. Spur feterita has an average percentage rating about 8 per cent higher than that of Dwarf feterita. This difference is significant but the Dwarf variety will produce a grain crop under extremely adverse moisture conditions when Spur will fail to do so. The forage production rating of the Dwarf variety is 11 per cent below that of Spur.

The kaoliangs have nothing to recommend them at Chillicothe. All are very poor forage varieties from the standpoint of both yield and quality.

Darso has consistently produced good yields of grain. This would be a most valuable variety at Chillicothe were it not for the high tannin content of the seed. The forage production of this variety has not been high but the quality of the stover is good.

Table 5. Yields of grain sorghum varieties at Chillicothe, 1914-31.

T. S. No.	Variety	Grain yield in bushels to the acre																			Average, bu.	No. years grown	Average		Com- par- able yield, bu.
																							Standard varieties for same period, bu.	Percent- age rat- ing	
		1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931						
	<b>Milo:</b>																								
1926	Early White	21.3	32.5	17.0	5.0	10.7	23.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....						
43	Dwarf Yellow	39.5	36.8	15.6	4.6	3.7	22.4	34.6	31.9	28.8	16.8	48.9	16.1	26.9	15.5	4.4	14.8	8.4	31.8						
4061	Dwarf White	.....	.....	10.9	6.1	3.0	16.2	26.8	34.5	29.1	10.7	47.3	15.1	24.4	12.3	1.8	16.9	5.5	30.1						
	<b>Kafir:</b>																								
9195	Texas Blackhul	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	41.6	22.7	32.6	6.3	31.9						
3295	Early Pink	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	25.1	52.3	41.7	24.0	35.8						
17485	Early Red	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	41.3	37.9	22.6	28.5	12.2						
6022	Blackhul 153	.....	.....	.....	.....	.....	.....	.....	27.5	34.8	24.3	40.9	35.0	43.9	44.0	22.5	36.1	1.8	27.8						
6824	Reed	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	43.5	26.2	42.8	44.7	27.7						
1927	Blackhul*	13.1	41.2	10.8	4.7	3.1	25.3	31.6	28.6	30.7	21.6	38.6	28.8	44.7	40.8	18.5	28.6	4.7	29.4						
45	Pink	13.4	46.1	0	9.4	0	27.7	30.8	29.3	29.3	18.4	33.0	.....	.....	.....	.....	.....	.....	.....						
1920	Whitehul	39.4	27.6	8.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....						
1939	Sunrise	17.2	32.1	10.8	4.4	3.2	23.9	29.0	27.2	31.4	.....	.....	.....	.....	.....	.....	.....	.....	.....						
46	Red	15.1	38.7	0	5.9	.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....						
	<b>Feterita:</b>																								
2840	Feterita 811	53.5	28.0	18.6	5.5	7.2	29.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....						
3232	Spur*	51.5	27.3	18.2	4.1	2.5	32.4	29.3	32.0	33.4	17.3	42.2	20.9	37.9	31.8	12.9	31.6	4.5	30.3						
5985	Dwarf	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....						
	<b>Kaoliang:</b>																								
1936	Red	.....	33.5	15.7	6.2	6.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....						
	White	.....	.....	11.7	.....	1.2	26.3	26.8	27.3	28.2	.....	.....	.....	.....	.....	.....	.....	.....	.....						
	<b>Miscellaneous:</b>																								
2897	Darso	.....	.....	11.0	7.3	2.7	34.7	36.1	27.7	37.7	38.4	42.6	28.8	43.6	44.0	21.5	26.4	14.9	34.8						
1923	Schrock	.....	46.1	8.8	5.4	1.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....						
6820	Premo	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....						
6823	Chiltex	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....						
1942	Hegari*	56.6	38.4	0	11.1	0	8.1	42.5	34.6	6.9	18.1	39.6	42.6	55.0	42.5	16.0	16.1	1.5	19.4						
8967	Fargo	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....						
41	Freed	20.0	27.7	11.7	5.7	6.5	20.1	23.3	24.7	33.8	.....	.....	.....	.....	.....	.....	.....	.....	.....						

\*Standard variety.

GRAIN SORGHUM VARIETIES IN TEXAS

Table 6. Forage yields of grain sorghum varieties at Chillicothe, 1914-31.

T. S. No.	Variety	Forage yield in tons to the acre																		Average, tons	No. years grown	Average		Com- par- able varieties for same period, tons
																						Standard varieties for same period, tons	Percent- age rat- ing	
		1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931					
1926	Milo:	3.06	2.37	1.25	1.03	1.38	1.83	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.82	6	2.72	87.0	1.91
43	Early White	4.70	3.60	1.35	1.25	1.62	4.08	3.01	1.85	1.85	2.15	3.29	2.07	2.20	1.48	.62	2.29	1.09	3.08	2.31	18	2.85	81.0	2.81
4061	Dwarf Yellow	.....	.....	1.16	1.37	1.47	1.90	2.17	1.94	2.27	1.80	3.08	1.85	2.19	1.52	.38	2.37	.92	2.76	1.82	16	2.66	68.6	1.96
9195	Kafir:	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5	2.85	98.2	2.80
3295	Texas Blackhul	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7	3.04	93.3	2.85
17485	Early Pink	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7	3.04	93.3	2.85
6022	Early Red	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10	2.98	81.3	2.82
6824	Blackhul 183	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	11	2.91	102.3	2.92
1927	Blackhul*	2.60	4.84	1.33	1.62	1.50	2.04	2.54	1.87	2.24	3.13	3.31	2.53	3.60	3.39	1.99	3.22	1.58	2.76	3.01	8	3.11	96.9	2.76
45	Pink	4.18	4.24	.98	2.62	1.29	1.94	2.56	2.19	2.96	3.06	2.06	.....	.....	.....	.....	.....	.....	.....	2.54	11	2.73	89.8	2.85
1920	Whitehul	4.55	2.60	1.29	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.81	3	3.39	93.0	2.65
4939	Sunrise	3.13	4.14	1.45	1.33	2.43	2.84	2.49	2.07	1.98	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.50	9	2.68	93.2	2.66
46	Red	5.60	4.09	1.06	1.78	1.32	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.77	5	2.77	100.1	2.85
2840	Feterita:	4.95	2.52	1.31	1.16	1.33	2.21	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6	2.72	82.6	2.85
3232	Feterita 811	6.05	2.47	1.37	1.10	1.07	2.74	2.90	1.73	2.12	1.50	3.22	1.85	3.15	2.69	1.59	2.92	1.68	2.98	2.40	18	2.85	84.0	2.40
5985	Spur*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8	3.11	73.2	2.09
1936	Dwarf	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	2.23	60.2	1.72
	Kaoliang:	2.25	1.20	1.21	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6	2.17	52.4	2.35
	Red	.....	.....	1.34	1.07	1.71	1.86	2.28	1.68	2.48	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	2.23	60.2	1.72
	White	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6	2.17	52.4	2.35
	Miscellaneous:	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6	2.17	52.4	2.35
2897	Darso	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16	2.66	79.4	2.26
2903	Schrock	3.88	1.38	1.38	1.31	1.49	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	2.23	96.0	2.74
6820	Preno	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8	3.11	92.5	2.64
6823	Chitex	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8	3.11	92.5	2.64
1942	Hegari	6.10	4.54	1.18	3.94	1.80	2.63	3.55	3.10	3.29	2.59	4.21	4.56	5.41	4.82	2.66	4.86	1.07	3.92	3.60	18	2.85	126.3	3.60
8967	Fargo	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8	3.11	96.2	2.74
41	Freed	2.78	2.05	1.06	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9	2.68	64.6	1.84

\*Standard variety

Schrock was grown for only four years and during that time the production was no better than that of adapted kafir varieties. Considering the fact that the seed of this variety are bitter, the variety is not recommended for planting here.

Chiltex and Premo have both been above the standard varieties in grain production. The results in this test do not indicate the fact, but Chiltex has been found to be particularly adapted to growing on deep sandy land.

Hegari has produced more forage than any other variety in the test at Chillicothe. The grain yields are good also in favorable seasons (Fig. 11). This variety has a place in this section as a bundle feed to be planted on land that usually is not subject to severe droughts.

Fargo is capable of producing good yields of grain and forage under favorable conditions but there is nothing in particular to recommend the variety for general planting.

Freed, on account of its early maturity, is capable of producing consistent yields. The production is never large, however, and the variety is not recommended for general planting.

### Results at Spur

Substation No. 7 is located in Dickens County one mile west of Spur. Spur is in the Rolling Plains Region, being 14 miles east of the Cap Rock escarpment, which divides the Low from the High Plains. The elevation is 2274 feet above sea-level. The average annual rainfall for a period of 21 years is 21.17 inches, 82 per cent of which falls during the growing season of summer crops. The average dates of the last killing frost in the spring and the first in the fall are April 2 and November 3, respectively. Abilene and Miles clay loams, two representative soils of the Rolling Plains Region, comprise soil types of the Station land. The optimum time of planting sorghums at Spur is about May 15 but they may be planted with success during the period of May 1 to June 15.

No insects are destructive to sorghums at Spur except the corn ear worm, which, in wet seasons, may cause considerable damage to yield and quality, particularly among the varieties with compact heads. No diseases other than red spot and kernel smut are present. The former does little damage and the latter is readily controlled.

Dwarf Yellow milo and feterita were used as standard, or check, varieties. Spur feterita was not grown until 1919 and prior to that time the yield of Standard feterita was used in its place.

Milo has produced the highest yield of grain over a long period and there is probably no significant difference in yield between Standard Yellow, Dwarf Yellow and Standard White (Table 7).

The kafirs are not so well adapted to conditions on tight land at Spur so far as grain yields are concerned, but they are among the best sorghums for bundle feed. Texas Blackhul is better adapted than the Standard kafirs.

Spur feterita has produced more grain than Standard feterita, the difference in the percentage rating of the two being about 10 per cent.



Table 7. Yields of grain sorghum varieties at Spur.

T.S. No.	Variety	Grain yield in bushels to the acre															Average, bu.	No. years grown	Average		Comparable yield, bu.	
																			Standard varieties for same period, bu.	Percentage rating		
		1914	1915	1916	1917	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1930						1931
	<b>Milo:</b>																					
672	St. Yellow .....			14.7		74.3	42.8	19.0	14.2	7.4	7.4	41.1						27.6	8	26.1	105.9	28.1
670	Dwarf Yellow* .....	68.7	36.2	19.9	7.2	53.0	45.6	26.1	15.7	10.2	7.9	45.4	31.2	14.0	26.7	2.7	24.4	27.2	16	26.5	102.6	27.2
1645	St. White .....	73.9	42.9	16.9	7.9	57.1	39.4	21.3	12.7	7.2	6.0	41.3						29.7	11	29.1	102.1	27.1
	<b>Kafir:</b>																					
9195	Texas Blackhul .....												38.9	17.4	28.0	.5	12.1	19.4	5	20.9	92.8	24.6
46	Red .....											46.4	27.7	0	21.3			23.9	4	28.2	84.6	22.4
45	Pnk .....											29.1	0	31.1				20.1	3	28.4	70.6	18.7
6022	Blackhul 153 .....											25.2	0	33.1		1.2		14.9	4	25.5	58.3	15.5
	<b>Feterita:</b>																					
3232	Spur* .....					72.9	43.4	20.3	15.0	8.9	9.9	9.4	38.4	26.1	34.1	2.1	9.0	24.1	12	24.7	97.7	25.9
40	Standard* .....	54.2	35.7	13.1	20.3	73.3	38.6	19.5	11.3	5.6	8.7	1.9						25.7	11	29.1	88.2	23.4
3231	Leafy .....					35.9	50.9	15.4	8.0	6.9	7.7	12.9			35.3	2.1		19.5	9	25.0	77.9	20.7
5985	Dwarf .....					28.8	35.7	15.6	18.9	13.2	8.9	10.9	22.5	26.5	19.9	5.8	16.7	18.6	12	24.7	75.4	20.0
	<b>Miscellaneous:</b>																					
6554	Dwarf White Yolo .....											35.9	35.3	36.9	29.4	14.4	18.0	28.3	6	22.0	128.9	34.2
6823	Chiltex .....												36.0	30.7	19.0	5.9	19.6	22.2	5	20.9	106.5	28.2
2897	Darso .....							16.4	12.0	11.8	4.8	31.1	25.5	28.1	26.9	11.6	16.4	18.5	10	18.9	97.7	25.9
6820	Premo .....												33.5	21.3	17.0	1.5	18.6	18.4	5	20.9	88.0	23.3
1942	Hegari .....		11.2	15.3		60.2	34.9	14.7	3.6	6.4	2.4	22.7	39.9	0	31.3	0	0	17.8	14	24.9	69.5	18.4

\*Standard variety. Standard feterita used 1914-17 only.

Spur feterita, which has replaced practically all other strains in Texas, is an especially good forage producer and is valuable for bundle feed. Leafy feterita is a high producer of forage. The Dwarf variety has produced a lower average yield of grain than Spur but has produced more than Spur in unfavorable years (Fig. 10).

The production of Darso has been slightly below that of the standard varieties at Spur.

During the five years it has been grown, Chiltex has produced more grain than milo or feterita and is apparently one of the best varieties for grain in this region. Its forage yield is low but it produces a high quality of bundle feed. The behavior of Premo at Spur does not recommend it but it does produce a good quality of forage.

Hegari is unadapted to conditions on tight land at Spur. Only twice in the 14 years that it has been grown has Hegari produced more grain than the standard varieties. This variety occasionally makes an excellent yield of forage and rarely fails to do so on sub-irrigated land. It is not dependable for grain on the tight soils of this region, and Spur feterita, Texas Blackhul kafir, Chiltex, and Sumac sorgo are more certain of production and more satisfactory as crops for forage and for binding and feeding in the bundle.

### Results at Big Spring

The Big Spring Field Station, of the Division of Dry-Land Agriculture, U. S. Department of Agriculture, is located one-half mile north of Big Spring, Howard County, in the South Plains Region at the southern edge of the High Plains. The altitude is 2400 feet above sea-level. The average annual rainfall over a period of 16 years is 18.61 inches, 80 per cent of which falls during the months of April through October. The average dates of the last killing frost in the spring and the first in the fall are March 30 and November 2, respectively. The principal soil type is Amarillo fine sandy loam.

The month of June is the optimum time of planting sorghum at Big Spring. Insect pests and plant diseases are not troublesome.

Dwarf Yellow milo, Dawn kafir, and Standard feterita were used as standard, or check, varieties.

The differences in yield among the milo varieties are probably not significant in spite of the apparently poor production of Standard White milo (Table 8).

Reed kafir and Standard Blackhul are the outstanding kafir varieties at Big Spring and there is a tendency for the late varieties to produce the best yields. A period of low rainfall during July and August has occurred more frequently at Big Spring than at other Stations. This fact has been an advantage to late varieties that have not headed until more favorable conditions have prevailed in the early fall.

Spur feterita has been the outstanding feterita variety at Big Spring but the yields are not much above those of the Dwarf variety.



Schrock, Darso, and Chiltex were the only miscellaneous varieties that produced more grain than the standard, or check, varieties. The first two are not recommended on account of the tannin content of the seed, and Chiltex has yielded somewhat less than the milos. None of the remaining varieties in this group apparently are as well adapted as milo, kafir, or feterita. Hegari has made very poor yields of grain at this Station.

### Results at Dalhart

The Dalhart Field Station, of the Division of Dry-Land Agriculture, U. S. Department of Agriculture, is located in Hartley County in the northern Panhandle. The altitude is 3978 feet above sea-level. The average annual rainfall over a period of 26 years is 18.80 inches. The distribution of rainfall during the summer months has been more favorable than at any other western Station, 87 per cent of the total falling from April to October, inclusive. The average dates of the last killing frost in the spring and the first in the fall are April 23 and October 17, respectively. Amarillo fine sandy loam predominates on this Station.

There is, in this region, a rather definite optimum planting date for sorghums, which is about the first of June. Insects and plant diseases are not troublesome to sorghums at Dalhart.

Dwarf Yellow milo, Dawn kafir, Sunrise kafir, and Standard feterita were used as standard varieties at Dalhart. Yields are shown for the years 1910 and 1911 but these yields did not enter into any of the averages. No data are available for the years 1913 to 1915, inclusive.

The milos have been the outstanding varieties at Dalhart and Dwarf Yellow and Standard Yellow have produced better than the others (Table 9). Double Dwarf Yellow has produced less than Dwarf Yellow in each of the years in which they were both grown except 1930. This slight difference in yield in favor of the Dwarf over the Double Dwarf variety is probably significant.

Reed, Dawn, and Sunrise have been the outstanding kafir varieties at Dalhart. The differences of 1.2 bushels and 1.6 bushels between the yields of Reed and Dawn and Reed and Sunrise, respectively, are probably not significant.

Standard feterita has been more consistent in producing good yields than the Dwarf or the Spur varieties.

Among the varieties classed as miscellaneous, no variety was outstanding or produced as well as the standard varieties. Beaver has not produced as well as Dwarf Yellow milo. Hegari has been much less consistent in grain production than the standard varieties, and in two years, yields of 0 and 2.6 bushels were made when the poorest yield among the check varieties was 13.6 bushels. When planted near the end of the planting season, June 15-20, Hegari yields compare more favorably with those of the better varieties.

### Results at Iowa Park

Substation No. 16 is located two and one-half miles southeast of Iowa



Park, Wichita County. The elevation is 974 feet above sea-level. The average annual rainfall for a period of 6 years is 31.98 inches. The average dates of the last killing frost in the spring and the first in the fall are April 6 and November 12, respectively. The soils comprising the Station farm are alluvial loams, silty clay loams, and clay loams of the Miller and Yahola series. Crops are grown at this Station under irrigation, the farm being in the Wichita Valley Irrigation Project.

Since irrigation water is available the optimum planting date at Iowa Park is not influenced greatly by the natural distribution of summer rainfall. No adequate information is at hand to fix the optimum date definitely but observations indicate that good results may be had from planting at any time during April, May or June, the June date being the best. Milo is subject to the same damage from chinch bugs here as at Chilli-cothe. Iowa Park is in the area of occasional sorghum midge infestation but only infrequent damage has resulted from this insect and that not severe.

The experiments cover a period of three years. The results secured over a three-year period are not adequate to justify definite conclusions but it is apparent that large yields of grain and forage may be expected. Iowa Park is definitely in the sorghum belt, and with cheap irrigation water available, economical as well as large yields of grain and forage are possible. This Station is in the midst of a cattle-raising country and the practice of raising feed and finishing cattle in the Wichita Valley might well be expanded.

The only outstandingly low yield of grain and forage was made by milo as the result of damage from chinch bugs, as previously mentioned (Table 10). The kafirs have made satisfactory yields but during these three years have not produced as much grain as some of the other varieties. Upon the basis of these three years' results it appears that excellent yields from any of the better varieties may be expected. Premo, Darso, Spur feterita, Hegari, and Chiltex have produced average yields above 50 bushels to the acre. Chiltex has made less forage than the remaining varieties, and Darso is undesirable on account of the high tannin content of the seeds.

### Results at Denton

Substation No. 6 is located five and one-half miles northeast of Denton, Denton County. The altitude is 600 feet above sea-level. The average annual rainfall for a period of 19 years is 32.81 inches, 68 per cent of which falls between the months of April and October, inclusive. The average dates of the last killing frost in the spring and the first in the fall are March 28 and November 12, respectively. This Station is in the important wheat- and oat-producing area of North Texas. The predominating soils are clays of the San Saba and Denton series which are typically developed on the Fort Worth Prairie, the northern part of the Grand Prairie Region.

The results from this Station cover a period of 4 years (Table 10).

## GRAIN SORGHUM VARIETIES IN TEXAS

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Table 10. Grain and forage yields of grain sorghum varieties at Iowa Park, Denton, Temple, College Station, Beeville, Weslaco, Angleton, Beaumont, and Troup, 1928-31.

Variety and Location	Grain yield in bushels to the acre					Forage yield in tons to the acre				
	1928	1929	1930	1931	Average	1928	1929	1930	1931	Average
<b>Iowa Park (irrigated):</b>										
Darso	45.0	47.0	-----	85.8	59.2	4.66	5.50	-----	5.97	5.38
Texas Bh. kafir	43.4	29.5	-----	57.6	43.5	6.38	6.70	-----	6.04	6.37
Dwarf Yellow milo	16.7	23.3	-----	34.7	24.9	.53	4.22	-----	2.90	2.55
Spur feterita	52.4	39.0	-----	75.0	55.5	3.30	6.74	-----	5.46	5.17
Hegari	60.7	32.0	-----	64.1	52.3	7.00	7.69	-----	5.53	6.74
Bh. kafir 153	41.9	27.0	-----	58.9	42.6	7.34	6.16	-----	5.85	6.45
Chiltex	35.3	42.1	-----	75.1	50.8	2.07	3.91	-----	3.99	3.32
Premo	57.5	41.5	-----	81.6	60.2	4.89	6.32	-----	5.96	5.72
<b>Denton:</b>										
Darso	43.2	35.9	19.0	36.8	33.7	-----	3.73	3.12	4.16	3.67
Schrock	46.4	36.2	10.5	28.2	30.3	-----	4.09	3.02	3.53	3.55
Texas Bh. kafir	34.9	32.5	21.9	18.0	26.8	-----	3.24	3.04	2.61	2.96
Dwarf Yellow milo	31.6	28.2	26.9	6.2	23.2	-----	1.67	2.25	.80	1.57
Spur feterita	31.8	28.6	16.7	24.2	25.3	-----	3.48	3.30	3.30	3.36
Hegari	45.2	39.6	32.0	21.9	34.7	-----	3.02	2.39	3.40	2.94
Bh. kafir 153	41.1	32.9	8.3	10.8	23.3	-----	3.60	3.04	2.95	3.20
Chiltex	46.1	33.5	22.0	26.3	32.0	-----	2.83	2.45	2.22	2.50
<b>Temple:</b>										
Darso	43.4	16.5	23.3	37.4	30.2	4.34	2.21	2.89	3.85	3.32
Schrock	33.9	17.8	17.3	29.7	24.7	4.43	2.56	3.12	3.79	3.48
Texas Bh. kafir	33.8	9.8	20.4	30.1	23.5	3.48	1.38	2.68	3.10	2.66
Dwarf Yellow milo	30.1	6.7	15.6	19.6	18.0	3.55	1.23	2.36	3.25	2.60
Spur feterita	22.6	11.3	19.7	30.5	21.0	4.71	1.63	2.90	3.75	3.25
Hegari	25.2	8.9	23.2	12.4	17.4	6.56	1.30	2.77	5.27	3.98
Bh. kafir 153	25.6	11.7	7.9	26.2	17.9	4.09	1.65	3.19	4.05	3.25
Chiltex	41.3	7.7	18.4	30.6	24.5	3.12	1.11	1.89	2.37	2.12
<b>College Station:</b>										
Darso	30.5	37.1	18.4	56.5	35.6	4.09	6.80	4.47	5.51	5.22
Schrock	27.9	22.0	12.0	40.0	25.5	3.88	5.69	4.01	5.00	4.65
Texas Bh. kafir	-----	32.6	-----	-----	-----	-----	4.91	-----	-----	-----
Dwarf Yellow milo	-----	13.8	-----	-----	-----	-----	3.95	-----	-----	-----
Hegari	-----	-----	-----	12.9	-----	-----	-----	-----	5.93	-----
Spur feterita	-----	-----	-----	23.2	-----	-----	-----	-----	5.01	-----
<b>Beeville:</b>										
Darso	33.3	31.7	39.4	8.7	27.0	-----	-----	3.79	1.74	2.77
Schrock	31.2	31.3	47.9	6.6	29.3	-----	-----	3.64	2.06	2.85
Texas Bh. kafir	32.1	34.3	37.0	16.4	30.0	-----	-----	2.38	2.06	2.22
Dwarf Yellow milo	39.1	15.6	29.3	8.2	23.1	-----	-----	2.20	1.12	1.66
Spur feterita	34.1	17.9	26.1	6.1	21.1	-----	-----	2.71	1.64	2.18
Hegari	33.9	17.3	26.8	8.3	21.6	-----	-----	1.60	1.02	1.31
Bh. kafir 153	29.0	27.7	40.3	5.4	25.6	-----	-----	3.82	2.03	2.93
Chiltex	36.9	38.5	51.7	19.6	36.7	-----	-----	2.92	1.80	2.36
<b>Weslaco (irrigated):</b>										
Darso	55.7	33.2	55.9	34.0	44.7	5.50	-----	-----	3.31	4.41
Schrock	-----	35.0	55.2	38.0	42.7	-----	-----	-----	4.13	-----
Texas Bh. kafir	33.9	0	0	-----	11.3	4.29	-----	-----	-----	-----
Dwarf Yellow milo	26.3	0	0	-----	8.8	5.32	-----	-----	-----	-----
Spur feterita	-----	-----	-----	14.0	-----	-----	-----	-----	5.53	-----
Hegari	20.8	-----	-----	10.0	-----	4.46	-----	-----	4.26	4.36
<b>Angleton:</b>										
Darso	10.5	8.3	5.2	26.5	12.6	3.24	1.82	3.18	3.37	2.90
Schrock	31.4	16.2	14.2	28.0	22.5	2.94	1.46	2.85	3.26	2.63
Texas Bh. kafir	0	0	0	-----	-----	2.62	2.13	2.44	-----	2.40
Dwarf Yellow milo	6.3	0	0	-----	-----	2.74	2.08	1.69	-----	2.17
Spur feterita	-----	-----	-----	0	-----	-----	-----	-----	3.12	-----
Hegari	-----	-----	-----	0	-----	-----	-----	-----	2.65	-----
<b>Beaumont:</b>										
Darso	-----	-----	12.7	16.1	14.4	-----	-----	3.37	2.89	3.13
Schrock	-----	-----	18.7	24.7	21.7	-----	-----	4.29	3.32	3.81
Spur feterita	-----	-----	0	0	-----	-----	-----	3.77	2.48	3.13
Hegari	-----	-----	0	0	-----	-----	-----	3.37	2.65	3.01
<b>Troup:</b>										
Darso	15.0	8.2	7.4	-----	10.2	-----	-----	1.34	-----	-----
Schrock	13.6	6.3	6.9	-----	8.9	-----	-----	1.60	-----	-----
Texas Bh. kafir	11.2	2.6	4.0	-----	5.9	-----	-----	1.60	-----	-----
Dwarf Yellow milo	20.3	1.4	4.5	-----	8.7	-----	-----	.57	-----	-----

Satisfactory average yields have been made with all varieties except milo, and the yields of milo are low on account of the presence of chinch bugs, which are numerous at Denton. Since milo is very susceptible to chinch bug damage, the yield of this variety is very often greatly reduced. Milo may be planted early, during late March or early April, or it may be planted late, during July, so as to evade the chinch bug. The sorghum midge has been present practically every year of the test and has occasionally reduced the yields of late-maturing varieties, like Blackhul 153, by as much as 50 per cent. The results of 4 years are scarcely adequate to justify conclusions as to the best varieties at Denton. Hegari, with an average of 34.7 bushels, has the highest production, followed by Darso, with 33.7 bushels and Chiltex with 32.0 bushels. The respective forage yields of these three varieties are 2.95, 3.68 and 2.50 tons. Texas Blackhul kafir, kafir 153, and Spur feterita, as well as Darso, produced more forage than Hegari.

#### Results at Temple

Substation No. 5 is located two miles south of Temple, Bell County. The altitude is 740 feet above sea-level. The average annual rainfall for a period of 19 years is 35.71 inches, 70 per cent of which falls between the months of March and October, inclusive. The average dates of the last killing frost in the spring and the first in the fall are March 25 and November 12, respectively. The soils on this Station are Houston clay and Houston black clay, the predominating soils of the Blackland Prairie Region.

The month of May appears to be the optimum planting period for grain sorghums at Temple; but unlike corn, which has a rather limited range of optimum planting, grain sorghums may be planted with good results at any time from March through June.

During the four years this experiment was conducted there was no damage from sorghum midge. Temple is, however, in the territory where the midge does occasional damage.

Fairly satisfactory yields were made in each year except 1929 (Table 10). Darso and Schrock have produced the highest and most consistent grain yields. Texas Blackhul kafir, Chiltex, and Spur feterita are also good yielding varieties for this region. Hegari has made the lowest average grain yields but the highest forage yields of any of the varieties. Darso, Schrock, and Spur feterita have also made good forage yields.

#### Results at College Station

The Main Station farm is located at College Station in Brazos County. The elevation is 308 feet above sea-level. The average annual rainfall for a 43-year period is 38.31 inches, 66 per cent of which falls between the months of March and October, inclusive. The average dates of the last killing frost in the spring and the first in the fall are March 9 and November 25, respectively. Fine sandy loam soil, of the Lufkin series, predominates on this Station.



The favorable planting period for sorghums at College Station is late April and May but earlier planting may be done and good stands obtained.

College Station is in the sorghum midge area and occasional severe damage results. Birds have been very destructive to developing seed of all varieties except Darso and Schrock.

Darso has produced the highest average yield of grain during the four years of the test (Table 10). The fragmentary results presented for Texas Blackhul kafir, Dwarf Yellow milo, Spur feterita, and Hegari are no indication of the yielding ability of these varieties, as in each year of the test birds have completely destroyed the grain on all varieties except Darso and Schrock except when protected as in 1929 and 1931, when yields of grain were obtained, (Figs. 12 and 13). If large acreages were planted the damage from this source would be greatly reduced and varieties other than Darso and Schrock, such as Hegari and feterita, might be grown.

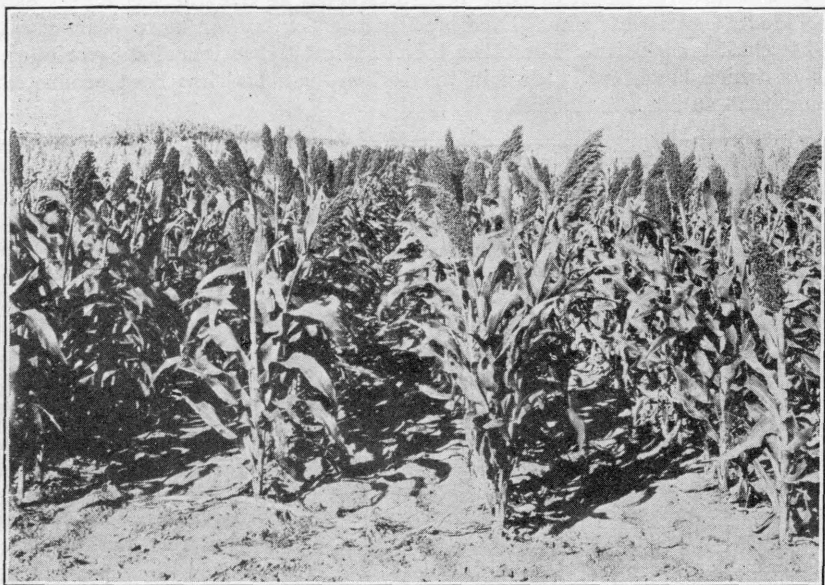


Fig. 13. Showing the growth habit of Darso, a good grain- and forage-producing variety for Central and East Texas.

#### Results at Beeville

Substation No. 1 is located in Bee County, in the Interior Black Prairie Region, at an altitude of 240 feet above sea-level. The average annual rainfall for a period of 28 years is 30.56 inches, 75 per cent of which falls between the months of March and October, inclusive. The average dates of the last killing frost in the spring and the first in

the fall are February 20 and December 7, respectively. Victoria and Goliad sandy loams and clay loams are the principal soils comprising the land on this Station.

Temperature conditions at Beeville allow a long period during which grain sorghums may be planted but damage from the sorghum midge is likely to be severe on any crop that heads in late June and in July, and the possible planting date is, therefore, limited to some extent. Date-of-planting experiments have indicated that for best results all varieties should be planted after March 10 and prior to April 15, but that Hegari can be planted up to May 1 better than other varieties. Also, Hegari can be planted after the rains start in the fall and produce a good crop of grain and forage.

In the test, results of which are shown in Table 11, Dwarf Yellow milo, Texas Blackhul kafir, Blackhul kafir 153, Spur feterita, Shallu, and Hegari were grown during the entire period and were used as standard varieties in computing average percentage rating and comparable yields.

Two tests with varieties have been conducted at Beeville. One test has included 16 varieties, which have been grown for two or more years from 1924 to 1931, inclusive. The other test (Table 10) has included 8 varieties, all of which have been grown in the former test, and has been conducted from 1928 to 1931, inclusive.

Except for the difference in performance of Chiltex, which produced well in one test and only fair in the other, the results (Tables 10 and 11) of the two tests are in rather close agreement.

The results indicate that Shallu, Texas Blackhul kafir, Darso, and Schrock are the varieties best adapted. Shallu has several objectionable characteristics, including a tendency for the seed to shatter and for the stalks to lodge. Darso and Schrock, (Figs. 13 and 12) have seeds with high tannin content and are, therefore, not considered to be as valuable as Texas Blackhul kafir and Hegari (Figs. 7 and 11). Chiltex has produced good yields of grain but the forage production is low. Hegari has not produced well in these tests at the Beeville Station for the reason that it is always damaged a great deal more by birds than any other variety of sorghum. Therefore, the yields obtained on this variety, when grown in field plats, are not equal to those obtained by farmers in this region, where Hegari is grown in larger fields and the bird damage is less severe. The popularity of Hegari in this section is due to the fact that it may be planted with good results during a longer period in the spring and summer than other varieties because it responds well to conditions when planted in the fall, and because it produces stover of good quality.

#### Results at Weslaco

Substation No. 15 is located about midway between Weslaco and Mercedes, Hidalgo County, in the Lower Rio Grande Valley. The elevation is 80 feet above sea level. The average annual rainfall over a period of 17 years is 22.96 inches, the greater part of which falls during the growing season of summer crops. The average dates of the last

Table 11. Yields of grain sorghum varieties at Beeville, 1924—31.

T.S. No.	Variety	Grain yield in bushels to the acre										Forage yield in tons to the acre								Average		No. years grown	Standard varieties for same period		Percent-age rating		Compar-able yield	
		1924	1925	1926	1927	1928	1929	1930	1931	1924	1925	1926	1927	1928	1929	1930	1931	Grain, bu.	Forage, tons	Grain, bu.	Forage, tons		Grain,	Forage,	Grain, bu.	Forage, tons		
670	<b>Milo:</b> Dwarf Yellow* .....	4.7	23.9	15.0	.5	33.2	18.9	48.7	11.8	1.31	3.97	1.17	.50	1.35	2.96	4.12	2.00	19.6	2.17	8	23.2	2.92	84.3	74.5	19.6	2.18		
9195	<b>Kafir:</b> Texas Blackhul* .....	12.2	35.0	30.0	10.2	32.5	26.5	50.3	19.0	1.86	3.78	2.73	2.31	2.04	4.35	4.47	2.58	27.0	3.02	8	23.2	2.92	116.1	103.3	27.0	3.02		
6022	Blackhul 153* .....	6.9	25.9	24.7	8.0	24.1	36.8	48.6	10.4	2.23	4.13	3.24	1.82	2.26	5.64	5.80	2.78	23.2	3.49	8	23.2	2.92	99.8	119.5	23.2	3.49		
17485	Red .....	.....	.....	17.1	6.3	18.3	15.0	38.7	2.5	.....	.....	.....	4.12	1.65	1.32	5.98	5.96	2.52	16.3	3.59	6	25.0	2.92	65.2	122.9	15.1	3.59	
3232	<b>Feterita:</b> Spur* .....	3.3	25.0	15.3	8.5	18.4	22.2	47.4	5.2	2.28	3.58	4.06	1.29	.91	3.04	4.70	2.08	18.2	2.74	8	23.2	2.92	78.2	94.0	18.2	2.74		
1553	<b>Miscellaneous:</b> Shallu* .....	12.1	32.7	29.7	13.2	15.0	39.0	95.9	20.1	1.85	3.86	2.14	1.10	1.60	4.19	7.04	2.73	32.2	3.06	8	23.2	2.92	138.7	105.0	32.2	3.07		
1923	Schrock .....	.....	.....	.....	.....	.....	.....	65.5	17.4	.....	.....	.....	.....	.....	6.35	2.78	.....	41.5	4.57	2	35.0	3.68	118.6	124.0	27.5	3.62		
2897	Darso .....	.....	33.6	28.6	14.7	15.9	46.9	56.0	6.0	.....	3.81	3.16	1.27	1.90	4.95	4.92	2.51	28.8	3.22	7	25.5	3.09	112.8	104.1	26.2	3.04		
9242	Wonder .....	.....	.....	.....	9.3	24.1	42.1	52.1	18.0	.....	.....	.....	1.79	1.27	2.90	3.67	2.54	29.1	2.43	5	25.9	2.99	112.4	81.5	26.1	2.38		
8705	Schrock (Sagrain) .....	.....	.....	.....	.....	10.4	40.3	68.0	15.2	.....	.....	.....	.....	.....	2.92	6.66	6.12	2.54	33.5	4.56	4	30.4	3.37	110.1	135.4	25.5	3.95	
6823	Chiltex .....	.....	.....	.....	.....	14.7	21.7	73.6	15.5	.....	.....	.....	.....	.....	1.21	1.73	4.75	1.51	31.4	2.30	4	30.4	3.37	103.2	68.3	23.9	1.99	
9193	Darso (Maizo) .....	.....	.....	.....	.....	21.6	37.1	57.6	2.0	.....	.....	.....	.....	.....	1.65	5.42	4.99	2.39	29.6	3.61	4	30.4	3.37	97.3	107.3	22.6	3.13	
6820	Premo .....	.....	.....	.....	.....	17.1	24.2	54.4	5.3	.....	.....	.....	.....	.....	2.15	4.72	5.59	1.11	25.3	3.39	4	30.4	3.37	83.1	100.7	19.3	2.94	
7313	Hegari* .....	3.2	29.4	8.9	6.9	30.3	13.3	52.7	9.2	.72	5.20	2.25	1.82	1.34	7.01	4.59	1.27	19.2	3.03	8	23.2	2.92	82.8	103.7	19.2	3.03		
9241	Feterita hybrid .....	.....	.....	.....	12.2	24.9	18.8	35.6	10.1	.....	.....	.....	.....	.....	1.65	1.60	2.74	3.93	2.78	5	25.9	2.99	78.5	85.0	18.2	2.48		

\*Standard variety

killing frost in the spring and the first in the fall are January 18 and December 25, respectively. Fine sandy loam, of the Victoria series, comprises the principal soil of this Station. Crops at this Station are grown under irrigation.

Sorghum midge frequently causes a complete failure in grain production of the grain sorghums and the lesser corn stalk borer is sometimes a factor in reducing yields. Sorghum midge was a factor of considerable importance during the unusually wet season of 1929 but the damage was not so severe in the next two years.

Grain yields of Hegari and Dwarf milo in 1928 were obtained from selected areas and are such as could have been expected without the bird-damage factor operating. The average production of Darso for the four years was 44.7 bushels and the average forage production for two years was 4.41 tons (Table 10). Darso and Schrock (Figs. 12 and 13) are the best adapted varieties at Weslaco. For some reason these two varieties seem to produce seed better under midge conditions than other varieties. They are also resistant to bird damage, which is important in a grain sorghum variety for this region. The other varieties appear not to be promising; however, if the bird damage factor could be eliminated, some of the better varieties, such as Hegari and feterita, might also be grown. Sorghums will probably be unimportant in this irrigated area except as crops to be grown for forage.

#### Results at Angleton

Substation No. 3 is located three miles northeast of Angleton, Brazoria County. The elevation is 23 feet above sea-level. The average annual rainfall for an 18-year period is 45.31 inches, the monthly distribution of which is adequate for sorghums but sometimes excessive for this crop. The average dates of the last killing frost in the spring and the first in the fall are February 28 and November 30, respectively. This Station is in the Gulf Coastal Prairie Region and the soils are loams, clay loams, and clays of the Lake Charles and Edna series.

Severe damage from sorghum midge may be expected frequently at Angleton, and bird damage is also severe, especially to yellow-seeded and white-seeded varieties.

During the 4 years of the experiment, Schrock (Fig. 12) has been the outstanding variety, yielding 22.5 bushels of grain (Table 10). Darso is apparently not as well adapted as Schrock. From the standpoint of grain production, Texas Blackhul kafir, Dwarf Yellow milo, Spur feterita, and Hegari have been failures. They are not as well adapted to this region and the birds damage them severely.

#### Results at Beaumont

Substation No. 4 is located six miles west of Beaumont, Jefferson County. The elevation is 28 feet above sea-level. The average annual rainfall for an 18-year period is 53.45 inches, which is fairly evenly

distributed throughout the months of the year. The average dates of the last killing frost in the spring and the first in the fall are February 26 and November 24, respectively. This Station is in the rice-producing region of the State and the soils on the Station are good rice soils, being clays of the Lake Charles and Crowley series.

During this experiment there has been difficulty in obtaining stands of sorghums on the heavy, poorly drained rice soils, but this is not usually the case on the lighter, better drained soils of the region. During the first two years of the test, birds completely destroyed the grain crop. Schrock and Darso have produced grain during the last two years, the averages being, respectively, 21.7 and 14.4 bushels (Table 10). The seed of Spur feterita and Hegari were completely destroyed by birds. Average forage yields of 3.81 and 3.13 tons were produced by Schrock and Darso. Schrock and Darso (Figs. 12 and 13) are the only two varieties that can be recommended for this section, although Hegari is quite satisfactory where sparrows are not so troublesome. When the crop is isolated from buildings, or planted in rather large fields, the damage from this source is much reduced.

### Results at Troup

Substation No. 2 was located one mile northeast of Troup, Smith County, at an elevation of 484 feet above sea-level. The average annual rainfall for a 26-year period is 42.72 inches, 66 per cent of which falls between the months of March and October, inclusive. The average dates of the last killing frost in the spring and the first in the fall are March 15 and November 17, respectively. The principal soil on this Station is Kirvin fine sandy loam.

The optimum planting period has not been definitely determined but probably April 15 through May is the most favorable period. Quite often drought periods during the summer make later plantings impracticable; however, if soil moisture is adequate during the summer, plantings may be made until August 1. Sorghums may sometimes be planted on tomato or other spring truck land after the latter crop has been harvested.

This Station is in the sorghum midge area but no midge damage was observed during the period of the test. Bird damage was rather severe during 1929 but was negligible during 1928 and 1930. The birds, principally sparrows, seemed to prefer the Dwarf Yellow milo and did the least damage to Schrock.

All varieties produced some grain during each of the three years that this test was conducted (Table 10), but the yields were quite low. The highest average yield was that of Darso, with Schrock second and Dwarf Yellow milo was a close third. Fertilizer applications used were equivalent to 500 pounds of 6-8-0 per acre during 1928, 400 pounds of 4-8-0 during 1929, and 300 pounds of 4-8-4 during 1930. The low yields were apparently not due to lack of mineral fertilizers since the applications made are considered rather heavy, and cotton fertilized in a similar

Table 12. Yields of new and hybrid varieties at Lubbock, Chillicothe, and Spur.

T. S. No.	Variety	Lubbock						Chillicothe						Spur	
		Grain yield in bushels per acre						Grain yield in bushels per acre						1930	1931
		1927	1928	1929	1930	1931	1932	1928	1929	1930	1931	1932	1930	1931	
<b>Milo and milo hybrids:</b>															
670	Dwarf Yellow	21.1	39.4			50.3	0	2.5	5.2	17.7	26.7	4.2	24.4		
13617	Day					26.9				22.9	29.3	5.1			
17998	Early White x Ex. Dwarf Yellow			7.4		38.6				9.4	9.4		6.9		
13352	Extra Dwarf White milo		28.0	12.0		40.6		1.2	4.9	20.3	20.3	0	11.6		
9626	Beaver					28.4				9.4	9.4				
	Custer					49.1				9.4	9.4		1.0		
17999	Wheatland														
18000	Wheatland x Dwarf milo														
13618	Dwarf Yellow milo x Pink kafir			13.1		39.4				27.1	27.1	1.9	1.0		
18001	Milo x kafir														
13611	Yellow kafir			15.8		5.8				0	0	2.0	18.0		
8867	Fargo	32.9	60.9				0	0		12.8	12.8				
18002	Manko		74.5				0	0		30.0	30.0				
8993	Bishop		72.4				12.3	2.5		0	0				
9765	Bishop (Algeria)	28.7	55.0				8.6	2.5		19.2	19.2				
8989	Desert Bishop						6.1	4.3		15.0	15.0				
13609	Pierce kafir									1.6	1.6				
	<b>Kafir:</b>														
9195	Texas Blackhul		55.7	19.1		35.2				6.4	6.4	1.0	12.1		
13613	Western Blackhul			15.0						6.1	6.1	3.9	11.1		
9711	Sharon		51.1												
18003	Blackhul														
18004	Red						4.9	15.3	1.5						
18005	Pink						22.1	15.3	6.7						
18006	Dwarf Early Blackhul						15.1	10.4	7.7						
13615	Dawn Sel.							6.1	8.6						
6022	Blackhul 153			13.8		41.7						1.6	15.2		
	<b>Miscellaneous:</b>											0	1.2		
2840	Feterita							23.9							
13619	Ajax			19.0		38.5		14.1	7.4				3.0		
8964	Wonder		37.7	15.4		46.3		15.9	10.1				16.4		
2897	Darso		46.4												
9193	Darso (Maizo)	30.8	47.1												
1923	Schrock	30.6	55.6												
8705	Schrock (Sagrain)	35.4	63.1												
13612	Club kafir			16.4		9.2							2.3		
13614	Modoc Pink Freed			4.2		10.6							28.1		
18007	Dwarf Freed					11.4							22.0		
13841	Grohoma					4.3			1.8				7.3		

manner on these soils has produced about one-half bale to the acre. The low yields may have been due partially to deficiency of soil moisture at critical periods, as the water-holding capacity of the soil is naturally low and drought periods are common during the summer. The forage yields, as well as grain yields, were low in 1930, the only year that forage yields were obtained.

Results at this Station indicate that grain sorghums cannot be recommended for the upland soils of this section except in instances where the corn crop promises to be a failure or where a late grain crop is desired to follow a spring truck crop.

### TEST OF NEW VARIETIES

During the past few years a number of new hybrid varieties have been given a limited distribution from experiment stations in Texas, Oklahoma, and Kansas, and these have been included in variety tests at Lubbock, Chillicothe, and Spur to determine their value in comparison with some of the standard varieties. Other varieties that have been, or are being, exploited have been included also. The yields produced by these varieties are shown in Table 12, along with the yields of some common varieties that were grown in direct comparison.

These new varieties are distinct in type from the commonly grown varieties and no doubt some of them will prove of value in certain regions. The results reported here are, however, too fragmentary for definite recommendations but some idea as to the value of these new varieties may be obtained by comparing their yields with those of Dwarf Yellow milo, Texas Blackhul kafir, and feterita. Such varieties as Day milo, Early White x Double Dwarf Yellow milo, Double Dwarf White milo, Beaver, and Wheatland are early, dwarf types which may prove of value in certain regions for combine purposes. Club kafir, Yellow kafir, and Wonder appear worthy of further trial. Ajax is a new hybrid variety of feterita x kafir parentage developed and, in 1931, distributed from the Chillicothe Station. It is a dwarf, straight-headed variety, is white-seeded with a brown undercoat, has about 16 leaves, and matures in 105 to 110 days. Ajax has given good yields in the hands of farmers, and further distribution of the seed is being made.

Bishop, Darso, and Schrock have recently been sold under the names of Algeria, Maizo, and Sagrain, respectively, but there is no evidence that they differ materially from the parent varieties and they yield no better. Grohoma has been widely exploited recently, seed sold at an exorbitant price, and extravagant claims have been made for it as a forage and grain crop. It is apparently a hybrid between feterita and some sorgo. Grohoma has produced unsatisfactory yields in comparison with the common varieties wherever it has been grown by the Texas Station.

Table 13. Key to accession numbers of grain sorghum varieties.

Variety	Number			
	T. S.	F. C.	C. I.	S. P. I.
<b>Milo:</b>				
Standard Yellow	672	-----	234	24963
Standard White	1645	-----	352	-----
Dwarf Yellow	670	-----	332	24969
Dwarf Yellow	43	-----	184	18684
Dwarf Yellow	8730	-----	332	24969
Dwarf White	3296	-----	-----	-----
Dwarf White	4061	5899	627	-----
Early White	1926	5886	480	-----
Double Dwarf Yellow	8728	-----	868	-----
<b>Kafir:</b>				
Standard Blackhul	6819	-----	-----	-----
Standard Blackhul	6818	-----	-----	-----
Standard Blackhul	674	-----	207	24975
Standard Blackhul	18013	-----	71	24979
Blackhul 153	6022	6607	-----	-----
Blackhul	18003	-----	204	-----
Blackhul	1927	5894	-----	-----
Texas Blackhul	9195	8962	865	-----
D. Ey. Blackhul	18006	8952	-----	-----
Dawn	673	-----	340	24983
Sunrise	1939	-----	472	32707
Whitehul	1920	-----	342	-----
Pink	45	-----	473	19742
Pink	3295	13642	432	-----
Pink	18005	9091	-----	-----
Red	46	-----	216	19492
Red	18014	-----	34	24985
Red	18004	8987	-----	-----
Red	1929	5895	-----	-----
Red	1928	5896	-----	-----
Red	1938	-----	-----	19751
Red	17485	6608	957	-----
Early Red	18015	-----	866	-----
Reed	6824	11574	628	-----
Rice	3682	-----	-----	-----
<b>Feterita:</b>				
Standard	1652	-----	182	19517
Standard	18012	-----	567	-----
Spur	3232	6601	623	-----
Dwarf	5985	6603	810	-----
Dwarf	2840	811	-----	22329
Leafy	3231	-----	-----	-----
<b>Kaoliang:</b>				
Barchet	18009	-----	310	22912
Red	1936	-----	-----	38197
Brown	1935	-----	-----	38086
Brown	1934	-----	-----	36963
White	18008	-----	-----	38205
Shantung Dwarf	18016	-----	293	22010
Manchu	18017	-----	171	18518
<b>Miscellaneous:</b>				
Acuff	1654	-----	-----	-----
Ajax	13619	6620	-----	-----
Beaver	9626	-----	871	-----
Bishop	18010	8993	814	-----
Chiltex	8219	8917	874	-----
Darso	2897	6606	615	-----
Desert Bishop	18011	8989	870	-----
Dwarf Freed	18007	-----	-----	-----
Early White x D. D. Y. milo	17998	8975	-----	-----
Fargo	8967	13643	809	-----
Freed	41	-----	350	29166
Hegari	1942	-----	620	34911
Hegari	7313	-----	-----	-----
Manko	18002	8991	-----	-----
Premo	8218	8929	873	-----
Schrock	1923	1481	616	-----
Shallu	1653	-----	85	-----
Smith milo hybrid	18018	-----	808	-----
Day	13617	-----	-----	-----
Wheatland	17999	-----	918	-----
Wheatland x D. Y. milo	18000	-----	918 x 332	-----
Wonder	8964	8986	872	-----



### KEY TO ACCESSION NUMBERS

The following tabulation of varieties and accession numbers assigned to the respective varieties by the Texas Experiment Station, the Division of Forage Crops and Diseases, the Division of Cereal Crops and Diseases, and the Division of Foreign Plant Introduction, and designated as T. S., F. C., C. I., and S. P. I. numbers, is included so that the varieties or strains may be readily identified as to origin and previous performance as reported upon in other publications. This key, reconciling the various accession numbers assigned to grain sorghum varieties during the past 25 years, includes most of the varieties tested in Texas.

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### SUMMARY AND CONCLUSIONS

Regional and local adaptation of varieties play an important part in the choice of varieties to grow. In the Great Plains Region where grain sorghum is particularly adapted all varieties produce quite well and the acreage devoted to a single variety in any locality depends largely upon whether the crop is to be used for grain or for forage, and sometimes upon quite local conditions that favor one or two varieties over all others. In the grain sorghum-producing area of Central and South Texas, however, certain varieties that are valuable in West Texas are not so important. In the other areas of the State, where sorghums are grown but little except for forage, only such varieties as Schrock and Darso have been found to do consistently well.

Quite local differences in soil and climatic conditions make it impossible to limit a recommendation to one or two or even three varieties because, in certain localities and under certain conditions, a particular variety that has rather limited adaptability may be the best possible variety to grow. For instance, a variety that is adapted to combine harvesting is valuable in the Panhandle but is of little use to a cotton farmer in the South Plains; Chiltex, which makes exceptionally good yields on deep sand along Red River, is not nearly so highly regarded on tight land 10 miles removed; and Hegari that will make enormous and consistent yields on sub-irrigated land, may fail to head so frequently on similar soil that is not sub-irrigated that the variety is considered worthless. These are only a few examples of conditions that justify the existence of many varieties and the distribution of still others as they are produced and found to be adapted.

There are extreme differences in type and behavior between grain sorghum varieties that allow a choice of a special variety to meet a particular condition. Many times conditions will arise, such as would follow a hail, wind storm, or an unlooked-for early drought, so that a farmer must change his plans for the current crop and plant an additional grain or forage acreage. Under such circumstances the present choice of variety in West Texas would be Dwarf feterita or Early White or

Yellow milo, and in South Texas it would be Hegari. Under conditions such as these, farmers should take advantage of the opportunities afforded by the diverse types to use the variety best suited to the particular situation.

West Texas has always been a milo country and that variety has been the popular one for purposes of heading, feeding, and marketing in the head. As the growing of cotton and wheat has increased in importance, varieties such as the kafirs, the feteritas, and Hegari have become important as varieties to be harvested with a row binder and fed to work stock and other livestock in the bundle.

In the Blackland Prairie Region good yields are occasionally produced by all varieties, but for consistent production of grain and forage, the feteritas, the early kafirs, Chiltex, Darso, and Hegari are best.

In the region south and west of San Antonio, all varieties will produce reasonably well, but all things considered, Hegari and Texas Blackhul kafir appear to fill the needs better than other varieties.

In the remainder of the State to the east, Darso and Schrock are the varieties best adapted but occasional good crops of feterita and Hegari are produced.

It might be pointed out here that in Central and South Texas, where grain sorghum production has been increasing in recent years and where environmental conditions are quite different from those existing in the Great Plains Region to the west and north, only the varieties grown or developed in the latter area have been tried because no others are readily available. There are excellent possibilities that better varieties for these newer sorghum regions may be produced than any at present being grown in these areas or in the sorghum belt proper.

The following varieties are deemed worthy of recommendation in the regions served by the designated stations, based upon their behavior in the yield trials and from a knowledge of the advantages, disadvantages, and the general adaptability of varieties to the needs of the various regions:

	Grain, bu.	Forage, tons		Grain, bu.	Forage, tons
<b>Lubbock:</b>			<b>Chillicothe:</b>		
Dwarf Yellow milo	30.8	---	Blackhul kafir 153	28.3	2.92
Texas Blackhul kafir	30.0	---	Texas Blackhul kafir	30.9	2.80
Spur feterita	27.6	---	Early Pink kafir	29.7	2.66
Sunrise kafir	30.0	---	Spur feterita	25.6	2.40
Chiltex	35.8	---	Chiltex	25.5	2.05
Hegari	23.9	---	Dwarf feterita	23.6	2.09
<b>Spur:</b>			Hegari	25.0	3.60
Dwarf Yellow milo	27.2	---	Dwarf Yellow milo	22.3	2.31
Spur feterita	25.9	---	<b>Big Spring:</b>		
Chiltex	28.2	---	Dwarf Yellow milo	22.1	---
Texas Blackhul kafir	24.6	---	Standard Blackhul kafir	24.9	---
Hegari	18.4	---	Reed kafir	26.6	---
<b>Dalhart:</b>			Dawn kafir	20.6	---
Dwarf Yellow milo	30.1	---	Spur feterita	20.7	---
Dawn kafir	25.9	---	<b>Iowa Park:</b>		
Sunrise kafir	25.5	---	Premo	63.5	6 59
Feterita	24.9	---	Spur feterita	59.2	5.98
Texas Blackhul kafir	23.2	---	Hegari	54.8	7.52
<b>Denton:</b>			Darso	62.7	5.96
Hegari	34.7	2.95	<b>Temple:</b>		
Darso	33.7	3.68	Chiltex	24.5	2.12
Chiltex	32.0	2.50	Texas Blackhul kafir	23.5	2.66
Feterita	25.3	3.37	Spur feterita	21.0	3.25
Texas Blackhul kafir	26.8	2.97	Darso	30.2	3.32
<b>College Station:</b>			Hegari	17.4	3.98
Darso	35.6	5.03	<b>Beeville:</b>		
Schrock	25.5	4.52	Texas Blackhul kafir	27.0	3.02
Hegari	---	---	Hegari	19.2	3.03
Spur feterita	---	---	Chiltex	23.9	1.99
<b>Weslaco:</b>			Schrock	27.5	3.62
Darso	44.7	---	Darso	26.2	3.04
Schrock	42.7	---	<b>Angleton:</b>		
<b>Beaumont:</b>			Schrock	22.5	2.63
Schrock	21.7	3.81	Darso	12.6	2.90
Darso	14.4	3.13	<b>Troup:</b>		
			Darso	10.2	---
			Schrock	8.9	---